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ABSTRACT

This manual is the final report of a study on the development of methods and programs to promote physical fitness among police officers. In twelve chapters the following topics are covered: (1) principles of exercise; (2) research methodology used to compile this manual; (3) results of physical fitness evaluation of program volunteers; (4) descriptions of the twenty week experimental exercise programs; (5) results and discussion of the twenty week experimental exercise programs; (6) attitudes and perceptions toward health and physical exercise; (7) results of national surveys on the number and type of physical fitness programs offered by police departments to their sworn officers; (8) administrative and developmental considerations and recommendations; (9) legal issues of concern to law enforcement officers and administrators; (10) medical screening and fitness evaluation programs; (11) recommended exercise program prescription; and (12) implementation experiences in other settings: business and industry. Appended are a medical history questionnaire, an informed consent form, and an aerobics exercise log. A bibliography for further reference is included. (JD)

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National Institute of Law Enforcement and Criminal Justice
Law Enforcement Assistance Administration
U.S. Department of Justice

Physical Fitness Programs for Law Enforcement Officers: A Manual for Police Administrators

by
Clifford S. Price
Michael L. Pollock, Ph.D.
Larry R. Gettman, Ph.D.
Deborah A. Kent

National Institute of Law Enforcement and Criminal Justice
Law Enforcement Assistance Administration
U. S. Department of Justice

National Institute of Law Enforcement
and Criminal Justice
Blair G. Ewing, Acting Director

Law Enforcement Assistance Administration
James M. H. Gregg, Acting Administrator

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PREFACE

This manual is the final report of a study entitled, "Development of Methods and Programs to Promote Physical Fitness Among Police Officers." The Study was funded by the National Institute of Law Enforcement and Criminal Justice, Law Enforcement Assistance Administration, U. S. Department of Justice, under Grant Number 76-NI-99-0011.

The complete description and analysis of the experimental exercise programs and attitudinal research conducted by the International Association of Chiefs of Police and the Institute for Aerobics Research of Dallas, Texas, is contained in Report 1, "Nature of Specific Exercise Programs," International Association of Chiefs of Police, Gaithersburg, Maryland, December 1976. Report 2, "Methods Police Departments Can Utilize to Determine the Need for Physical Fitness Programs: Recommended Program Implementation", International Association of Chiefs of Police, Gaithersburg, Maryland, December 1976, is incorporated as a part of this manual. A third volume, "Physical Fitness Practices, Attitudes, and Perceptions," International Association of Chiefs of Police, March 1977, contains the products of our field work, and the complete narratives of the results of the two national surveys conducted.

Appended to the end of this manual, for the reader's reference, is an annotated bibliography of readings related to physical fitness testing and exercise.

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Clifford S. Price
Project Director

SUMMARY

In recent years, scientific interest and concern about the relationship of coronary heart disease (CHD) to physical fitness, and the importance of other physiological and socio/psychological benefits of exercise, increased significantly. Numerous population studies have been conducted on various age and occupational groups to determine the value of physical activity as a means of preserving or enhancing health. These would include studies of London transport employees (19), Los Angeles City civil service employees (3), farmers, (28), postal workers (14), and railroad workers (26) to name a few. Additionally, studies to determine the physiological effects of exercise training have been conducted on sedentary men 49 to 65 years of age (23), track athletes 40 to 75 years of age (24), and numerous other individuals who voluntarily and individually participate in exercise training (6).

As extensive as the general literature is on physical fitness, few references could be found regarding physical fitness and the police. This is unfortunate considering the fact that the sedentary nature of police work, coupled with shift work, job-related stress, and numerous other factors, contribute to a high rate of coronary heart disease among police officers (29). To a certain extent, the police have been and are cognizant of the need for their members to be physically fit. In the year 1900, at the Seventh Annual Convention of the Police Chiefs of the United States and Canada, the conference program contained information promoting physical fitness for police officers (30). In 1924, the National Committee on Police Welfare conducted a nationwide survey to determine the types of sports and recreation programs and facilities existing in police agencies (7).

The related studies and past and present interest of the police, however, have not provided a systematic determination of what the fitness and programmatic needs of the police are. A clinical and analytical examination of the physiological fitness of deputies was conducted by the Los Angeles County Sheriff's Department (16). However, the study did not include a consideration of the socio/psychological effects of exercise, nor did it consider different approaches to implement, organize, and administer police fitness programs. The lack of much evidence concerning fitness standards and programs for the police indicated the need for further inquiry and provided the impetus for the undertaking of the research conducted.

The police are enigmatic in terms of their apparent attitudes and practices relative to physical fitness. There is universal agreement that there are times when on-the-job physical requirements are extremely high and that the patrol officer has to be capable of performing these physical feats when the occasion arises. Yet, available indicators point to the generalization that after the completion of recruit training, individual police officers show little initiative to keep themselves prepared to perform the varied physical requirements of the job. Furthermore, few police administrators have approached this problem programmatically.

Consequently, what is needed in the field of law enforcement is the systematic development and evaluation of programs and methods that can be used to ensure a high level of physical fitness among police personnel. This is the objective of this project.

How to Read the Manual

In order to facilitate easy access to specific material, the manual is divided into two parts. Part I, Methods and Findings, chapters 1 through 7, discuss the research conducted during the experimental portion of the study. Part II, Implementation, discusses administrative considerations, legal issues, and the recommended programs. This final section of the manual is an annotated bibliography which will provide a comprehensive reading list for those who wish to make a further study of physical fitness.

Throughout the manual you will observe a reference number following a citation from another published work. In many cases, several numbers will follow in sequence. This reference system was utilized in lieu of conventional footnote protocol to provide the reader with a bibliographical list of references at the end of each chapter.

THE PHYSICAL FITNESS STUDY

To accomplish the project objective, three broad areas relative to physical fitness and physical fitness programming were investigated. First, a variety of exercise programs were designed and conducted in controlled environments to assess the physiological effects of exercise on selected police personnel. Particular attention was given to the cardiovascular condition of the subjects since heart and circulatory diseases are two of the leading causes of nonaccidental disability retirement among police officers.

Secondly, socio/psychological factors were investigated to determine how these factors influence an individual's perception of physical fitness and his decision to participate in a fitness program.

The third area investigated in this study was a survey of the types and quality of physical fitness programs already in existence in various police departments. Information relative to the nature of the programs, methods of program organization and administration, levels of participation, legal aspects such as liability, and measures of effectiveness were investigated. In conjunction with the national survey of police agencies, a survey of police officers was conducted for the purpose of obtaining individualistic responses to a number of questions which impact on the effectiveness of fitness programming and program administration.

The project was initiated with the primary purpose of developing physical fitness programs for law enforcement officers. However, prior to recommending exercise and fitness programs for the nation's police officers, it became necessary to investigate several areas of concern regarding the police and physical fitness.

First, we were interested in the current physical fitness status of police officers. Secondly, we desired to present the police community with evidence that the physical condition of police officers could be improved in a relatively short period of time. Third, we endeavored to discover the attitudes and perceptions of police officers toward health and physical fitness. We were also concerned about the problems of stress, related to police work, and desired to determine if participation in regular physical activity had any relationship upon the anxiety levels experienced by the police officer. Fourth, we felt it was necessary to determine the physical fitness programs currently employed by law enforcement agencies, and the attitudes of police officers concerning these programs.

Fifth, it was our objective to present to the law enforcement administrator, physical fitness programs which could be implemented within their agency. In order to accomplish the work involved in this program, the International Association of Chiefs of Police selected The Institute of Aerobics Research of Dallas, Texas, to conduct the controlled experiments and related tasks of the project. IAR and its staff, whose unique experiences and capabilities in the area of exercise physiology are well known, immeasurably strengthened the final work accomplished in this project.

This manual is the final report of this study. Three previous reports which provide the complete description and analysis of the experimental program, and the field work accomplished, have been previously submitted to The National Institute of Law Enforcement and Criminal Justice.

RELATIONSHIP OF PHYSICAL FITNESS TO THE PREVENTION OF HEART DISEASE

Prior to discussing this report, it is necessary to summarize the beneficial role of physical fitness in its relationship to the prevention of coronary heart disease. The deposition of cholesterol (fatty plaques) in the blood vessels of the heart and throughout the body is one of the factors resulting in high blood pressure and/or coronary artery disease. The plaques build up in the arteries like boiler scale in water pipes. This reduces the internal diameter of the arteries, which causes a more rapid blood flow, and is one factor in increasing blood pressure. The increased flow rate and turbulance in areas of deposits irritates the lining of the arteries and may dislodge plaques or cause clot formation. These dislodged clots or plaques can then clog the arteries of the heart or brain and stop blood flow to the tissue. This deprives the tissue of oxygen and nutrients, and can result in tissue death. When tissue death occurs in the heart, it can cause an irregular heartbeat (arrhythmia) and the heart may fibrillate (beat very rapidly) or stop entirely. This is called a heart attack. There may be permanent heart tissue damage without any symptoms being present or noted, unless identified by change from normal baseline Electrocardiogram (EKG). Partial clogging of heart blood vessels can cause Angina (severe chest and/or left arm pain) on exertion. Coronary heart disease has been related to several risk factors. These include high serum lipids (cholesterol and triglycerides), excessive body fat, elevated blood pressure (hypertension), smoking, elevated blood sugar (glucose) and uric acid, excessive emotional stress, physical inactivity, and family history (1,8,10, 12-15).

Although there are some conflicting views, recent studies by Morris _et al_. (18), Paffenbarger and Hale (20), and Cooper _et al_. (5) have placed strong evidence in favor of the role that exercise plays in preventive medicine. Morris _et al_. (18), in studying the leisure-time habits of over 16,000 male executive grade civil servants from 40 to 64 years of age, concluded that vigorous exercise apparently protected them against sudden fatal heart attacks and other first clinical attacks of coronary heart disease. The study by Paffenbarger and Hale on 6,351 longshoremen, 35 to 75 years of age, indicated that the workers classified in a high caloric output job task had significantly lower death rates from coronary heart disease than those in a low energy cost job. Cooper, in a cross-sectional study on 3,000 men, found a significant relationship between level of cardiorespiratory fitness and selected risk factors and fitness variables (serum cholesterol, triglycerides, glucose and uric acid, systolic blood pressure, percent body fat and weight, resting heart rate, and forced vital capacity). Thus, through the reduction of risk factors associated with coronary heart disease, an officer who exercises and becomes physically fit may be indirectly protecting himself from heart disease.

In the context of this report a police officer with good physical fitness is considered to be one who possesses an efficient cardiovascular-respiratory system (good aerobic capacity), moderate to low levels of body fat, and adequate muscular strength, endurance, and flexibility. With these characteristics an officer would possess the means to accomplish daily tasks, both occupational and recreational without undue fatigue or risk of injury.

There are three basic components of physical fitness: cardiorespiratory fitness (CR), body composition, and musculoskeletal fitness. CR fitness, or aerobic capacity, involves the body's ability to transport and utilize oxygen. One of the main objectives of an aerobics program is to increase the maximun amount of oxygen that the body can process within a given time. The aerobic process depends on the oxygen transport system, which includes the lung's ability to take in large amounts of air and diffuse it into the bloodstream, the heart's ability to pump large amounts of blood to the tissues, and the tissues' (cells) ability to utilize the oxygen. The magnitude of improvement in aerobic capacity depends upon the total work accomplished, i.e., the energy cost of the activity involved. The energy cost, however, is dependent upon several variables, namely the intensity, duration, and frequency of the work (21). Other factors such as the regularity of the work, the mode of the work, as well as the age of the individual doing the work all influence the improvement in CR fitness (22-25). With adequate intensity, duration, and frequency of training, an officer will experience the "training effect" (4), whereby the organ systems of the CR system collectively operate to provide more effective transportation and utilization of oxygen and elimination of waste products.

Intensity, duration, and frequency in relation to the total work done in an activity also have a direct influence on the body composition of an individual. Body composition is divided into two components: lean tissue (bone, muscle, and body fluids) and fat tissue. Percent fat is the percentage by weight that the fat weight is of the total body weight.

Through the process of becoming physically fit, one can alter body composition (percent fat) (2). The major factor in this alteration is related to the number of calories expended (regardless of activity mode) in relation to the number consumed. Thus, by expending calories through some physical activity in addition to those expended to maintain body functions and by reducing the caloric intake, one can achieve a negative caloric balance. As a result, the body is forced to obtain the additional energy it requires from fat breakdown, thus reducing the fat content of the body.

Physical activity is a major factor in fat reduction in that it can maintain or even increase the lean tissue weight while fat weight is reduced. A study by Zuti and Golding (28), has shown that dieting alone can reduce body weight, but the net percent fat loss is reduced because of a decrease in muscle mass with the decrease in fat. (Muscle is catabolized by the body for energy as is fat.) Ideally, a reduced calorie intake should be combined with an exercise program to lose body fat as well as weight. Then, once a desired level of body fat is achieved, regular exercise coupled with a sensible diet can maintain satisfactory body composition.

The third component of physical fitness, musculoskeletal fitness (MS), encompasses two major areas: a) muscle strength and endurance and, b) flexibility. Muscle strength and endurance are interrelated and the development of either or both is dependent upon the training regimen involved. Muscular strength is the muscles' ability to generate a force against some resistance and is proportional to the cross-sectional area of the muscle or muscle group involved. Strength is developed through two major types of training: isotonic, which involves muscle shortening and lengthening with a corresponding movement of a related limb, and isometric, which involves muscular contractions but no movement of limb.

Muscular endurance is the ability of a muscle or muscle group to maintain repeated contractions of equal force until fatigue causes cessation. It is interrelated with strength in that the stronger muscle generally has more endurance.

With regard to the development of strength and endurance, isometric resistance training develops strength with little or no endurance improvements, while isotonic resistance training when done correctly (exercising through the full range of motion of the muscle groups involved), increases strength as well as endurance. Depending upon the combination of resistances and repetitions employed, isotonic training can develop strength or endurance. Generally, high resistance with low repetitions increases strength, while, conversely, greater repetitions and lower weights, increase endurance. Obviously, a compromise in approach will develop adequate strength and endurance.

When training for either strength or endurance, the overload principle is imperative for improvement. Simply, the overload principle involves increases in resistance and/or number of repetitions as the muscle adapts. However, once adequate strength and endurance are achieved, fewer workouts are necessary to maintain that level.

While muscular strength and endurance are critical to MS fitness, the ability of the MS system to move through a full range of motion is imperative. Flexibility can be defined as the ability of a joint or group of joints to move through a full range of motion. This range is affected by two factors: the boney structures comprising the joint and the extensibility of the surrounding ligaments, tendons, and muscles. It is obvious, therefore, that improvements in flexibility depend upon the development of the extensibility of these ligaments, tendons, and muscles.

Two types of stretching are employed to develop flexibility. These are static and ballistic. Ballistic stretching (stretching through momentum of movement) has its value primarily in warm-up of the entire body but could be harmful if not done properly. Static stretching (firm, steady stretch), however, involves less chance of muscle soreness and applies more specific stretching to a particular area. Research has shown that flexibility reduces injury, enhances skill, and allows for more graceful movement (17).

In addition to stretching, several other factors have been associated with flexibility. These include the degree of activity, age, sex, and environmental temperature (9).

Two general principles that are important to consider when developing an exercise program include the warm-up and cool-down. A general warm-up program of several minutes involving calisthentics, jogging, and stretching provides several benefits. By warming-up, the internal temperature of the body is raised. This condition allows for an increased rate of biochemical reactions involving the production of energy for exercise. Also, circulation and respiration are stimulated. All of these factors not only accelerate the adaptive process of the CR system, but also render the MS system more flexible, stronger, and better prepared for work.

After physical activity has been completed, a gradual cool-down greatly benefits the recovery process. Walking or jogging during the cooling-down period enables the body to better maintain uniform circulation, and thus more efficient removal of biochemical waste products, some of which are associated with muscle discomforts.

THE EXPERIMENTAL PROGRAM

Participant Selection and Testing

Volunteer officers from three police agencies were solicited to participate in the physical fitness evaluation tests and experimental exercise programs. Volunteers were required to be sedentary (not currently involved in any type of regular exercise activity) and willing to be placed in any of the several exercise programs or the control group for a period of twenty weeks. Two hundred fifteen officers, including 8 female officers, were selected for the initial fitness evaluation.

Two hundred thirteen officers completed the fitness evaluation which included: completion of a medical history questionnaire; recording resting heart rate; submaximal cardiovascular function; maximum cardiorespiratory function; body composition; vital capacity of the lungs; analysis of cholesterol, triglycerides and serum glucose; and a series of field tests to determine strength and flexibility.

Physical Fitness Results

The officers were categorized as young, ages 20-35, and older 36-52. The results of the initial evaluation tests showed a distinct increase in coronary heart disease (CHD) risk with age. Coronary heart disease has been related to several risk factors. These include high serum lipids (cholesterol and triglycerides), excessive body fat, elevated blood pressure, smoking, elevated blood sugar and uric acid, excessive emotional stress, physical inactivity and family history. The testing also showed that while younger officers 20-35 compared favorably to the normative population in working capacity, cardiorespiratory endurance, pulmonary function, serum lipids and motor ability, they generally experienced excess body weight, larger waist circumference, vital capacity and trunk flexion. The percent body fat between the groups was similar, thus the heavier weight is considered as a result of more bone and muscle tissue. Since the average person in the U.S. is considered below standards in physical fitness compared to many other industrialized countries, the standards should be thought of as inadequate for young police officers.

The police officers aged 36-52, when compared to the normal sedentary population of similar age, were considered below average in working capacity, cardiorespiratory fitness, and body composition. Specifically, the results show officers in this age group low in treadmill performance, maximum oxygen intake, and efficiency on a bench step test. They had excessive body weight and fat, increasing waist circumference and high serum lipids.

These results are similar to the 1973 study conducted in the Los Angeles County Sheriff's Department where the deputies were found to be overweight, tend toward high cholesterol and triglyceride values, smoke excessively, and do not get enough exercise. In comparison with a study of inmates in correctional institutions, inmates are generally in better physical condition than law enforcement personnel.

Exercise Programs

After completing the cardiovascular-respiratory fitness tests, the participants were randomly assigned to specific exercise groups. All officers were asked to exercise 3 days per week for approximately forty-five minutes each exercise session. The first fifteen minutes of each workout was devoted to a standard warmup period involving various stretching and calesthenic exercises. The remaining thirty minutes of each workout were devoted to specific exercises for each group.

One group of twenty officers from the Richardson, Texas, Police Department and the Texas Department of Public Safety were assigned to work out without special facilities or equipment. A 440-yard running path was marked off in a local park in a grassy area. Initially, the participants walked and jogged equal distances, however, as the training continued over a twenty-week period, the individuals walked less and jogged longer distances.

Officers aged 21-35 from the Dallas, Texas, Police Department were assigned to different exercise groups. The training was conducted at a facility which was equipped with warmup rooms, weight lifting equipment and a quarter-mile cinder track. Exercycles and treadmills were available to the participants for use in the event of inclement weather or nagging injuries; such as, shin splints and muscle pulls. Thirty officers each were assigned to the Interval Program, the Continuous Program, and the Combined Program. The Interval group alternated short periods of high intensity work (running) and low intensity work (walking). The Continuous program consisted of walking and jogging equal distances, but progressed through the twenty-week program so individuals walked less and jogged longer distances. The Combined group alternated days of training between the Interval and the Continuous program. Twenty officers in the age group 21-35 were placed in a weight training program. This program was designed so that initially the individual worked at approximately 50 percent of his one-repetition maximum strength on various exercises. The number of repetitions per exercise was increased from ten to twenty per set for the first 6 weeks, and then reduced to fifteen per set for the remaining fourteen weeks. There were a total of thirty-two younger officers assigned to control groups. These men received the initial physical fitness screening evaluations, but did not participant in any of the exercise programs.

A total of fifty-three officers ages 35-52 were divided into 3 groups. A supervised group consisting of twenty men, exercised on an oval 440-yard cinder track in a walk-jog program. Twenty men participated in an unsupervised program. They were supervised for a total of 4 weeks and then were required to train in locations of their own choice without supervision. Every 2 weeks they were required to return to the central training location for one exercise session to check their program. Thirteen older officers were assigned to a control group.

In order to estimate the intensity of the exercise, all officers in the exercise programs were asked to record their heart rates by the palpation technique at the middle (15 minutes) and the end (30 minutes) of each workout. In order to quantify the training of the running programs, the distances and times of the walking and jogging segments were recorded for each workout. The weight training program was quantified by recording the number of repetitions and weight used for each exercise.

Results of Exercise Programs

Upon completion of the exercise program, the participants were again tested using the same protocol as used at the start of the project. When comparing the runners with their respective control groups, resting heart rate was significantly lowered through twenty weeks of running. Young runners lowered their resting heart beats by 5 beats/minute and the middle-age runners by 8 beats/minute. A similar observation was made for recovery heart rate. The weight training program did not provide a statistically significant reduction in resting or recovery heart rate. Resting blood pressure did not change for any of the exercise or control groups. Treadmill performance time and maximum oxygen intake was significantly improved in all running groups. Body weight did not significantly change, however, the percent of body fat showed significant reduction in all runners. The weight training group greatly increased lean body mass. While gaining an average of one pound, they lost a significant amount of fat. The results of the motor ability tests also were greatly improved. The cholesterol and triglyceride changes for the runners ages 36-52 also appears significant.

The various exercise programs significantly affected the participating officers. The physiological changes observed on the young and middle-aged runners were in desirable directions, resulting in improved working capacity, cardiovascular function, body composition, muscular endurance and strength. The weight training program did not affect cardiovascular function, but significantly improved treadmill running performance, body composition, strength, and muscular endurance measures. Based on these results, it was concluded that future programs for police officers should include a combination of running, strength training, and motor ability development.

Psychological Aspects of Physical Fitness Training

Prior to their first visit to the laboratory for initial physical fitness tests, each participant was required to complete a battery of pencil and paper instruments. These instruments included a background information report providing personal information concerning current assignment, medical problems, experience with formal fitness programs and family exercise patterns, a self-evaluation questionnaire, attitude assessment, physical fitness and job-related information, health opinions and project participation survey. These instruments were also administered after the participants had exercised for 10 weeks and upon completion of the twenty-week experimental programs.

The purpose of this portion of the study was to determine how socio/psychological factors influence an individual's participation in physical fitness programs, to what extent do others influence his attitude, what are the self-reported benefits realized as a result of participation, and if perceived stress can be reduced by participation in a physical fitness program.

Results

After twenty weeks of physical fitness training, participating police officers gave significantly higher self-evaluations of physical ability. Younger officers in the running and weight training programs rated themselves significantly higher in speed, endurance, agility, strength, and combat skill. Older officers in supervised and unsupervised training programs saw themselves as significantly improved in speed, endurance, and agility. Richardson and Texas Department of Public Safety officers rated their endurance significantly higher. A more general question concerning overall physical fitness yielded significant mean rating increases from pre- to post-test for younger and older Dallas experimental group officers; Richardson and Department of Public Safety officers exhibited a nonsignificant trend toward higher self-evaluations on this question.

A trend toward what may be termed more realistic appraisals of self in relation to generalized others accompanied these significant increases in perceptions of physical fitness. Decreases in ratings of "easy" and "could pass now" occurred on items concerning entrance-level medical examinations and physical agility tests, as well as recruit academy physical standards for officers in the training groups. At the same time, the importance of these tests in relation to current position also declined from pre- to post-tests. The tendency to rate fellow officers low on general physical fitness decreased across time as well as participants perhaps became more aware of their own limitations.

No significant changes from pre- to post-test occurred with respect to either perceptions of the police job or general attitudes about health. Participants across all groups perceive their jobs as physically and emotionally more dangerous than other occupations in both general and situation-specific terms. Stress and tension result from a variety of sources, including perceived lack of awareness and concern on the part of departmental management, frustrating contacts with the judicial system, the effects of working hours on personal life (particularly in terms of marital problems and children), and associations with other officers who have suffered from a diversity of problem situations (e.g., alcohol, finances, marriage, children, neighbors, suicide, and heart attacks).

Initial awareness of the importance of personal attention to health was quite high among participants, and this attitude was maintained across the twenty weeks of training. Generally, officers in all groups exhibited feelings of concern over their health and heart destinies, but such concern was coupled with a high sense of control, in terms of being able to prevent illness. Participants considered the amount of physical activity/exercise and the amount of stress/tension as most important factors in preventing heart attacks, but food and sleep were also rated as important.

It can be concluded, then, that these officers are aware of both the stress associated with their occupation and their own ability to control their health. That these perceptions are not translated into actions is obvious from the lack of self-initiated exercise programs. Although officers have a history of participation in sports during their educational years, few have maintained regular exercise on their own. Many of the officers indicated opposition to the establishment of mandatory exercise and/or testing programs in their police agencies. These results seem to reflect the common situation existing in society as a whole, i.e., although personal experience leads to knowledge of the value of exercise, and while voluntary participation is preferable to mandatory programs, regular physical activity is simply not a part of many people's lives.

Results from two questionnaires clearly indicate a high degree of satisfaction among both officers and wives with physical fitness training programs. Officers in the experimental groups reported that favorable changes on six factors of physical condition and six factors of mental condition had occurred as a result of participation in these programs.

Favorable change in physical condition was indicated by the greatest number of officers for amount of fatigue, general activity level, and general physical fitness. It should also be noted that 95 percent of the older officers reported favorable change in their weight after the twenty-week program. Wives confirmed these results in their high ratings of favorable change in their husbands' conditions on these same factors. In addition, sex life improved for over 25 percent of both officers and wives. Control group officers and wives indicated no change, as expected, although in some cases unfavorable changes were cited.

Favorable changes were indicated by a majority of experimental group officers on four factors of mental condition, i.e., worry about health, self-confidence, ability to relax, and tenseness. In addition, particularly among younger officers, favorable change was noted in job satisfaction and worry over non-health matters. Again, these results were echoed by the wives, although responses here were somewhat more moderate.

These results are important for several reasons. Feelings of increased physical and mental fitness parallel actual physiological improvements. Thus, officers are more fit and feel more fit. Perceived psychological improvement is as important as incentive to participation in a fitness training program as actual physical improvement. The increased job satisfaction noted among younger officers may also be an important incentive for participation in voluntary fitness programs. Increased self-confidence and ability to relax and decreased tenseness are widely thought to be correlates of increased physical fitness; the results reported in this study tend to confirm this belief.

While self-perceptions of increased physical fitness are of primary importance, perceptions of what have been termed "significant others" are of at least secondary importance. In this study, the significant other consisted of the participating officer's wife. Appreciation of increased physical and mental condition by the officer's spouse is a powerful incentive for continued participation in fitness programs.

Equally important are the results from both officers and wives concerning the fitness training programs themselves. Both groups of respondents overwhelmingly indicated desire for continued participation. Officers in control groups and wives across all groups indicated a desire to participate themselves in such a fitness training program. Nearly all officers and wives in all five groups felt that this or a similar physical fitness training program would be beneficial for all police officers and further indicated that participation had increased their interest in fitness in relation to themselves, as well as other members of their families. The benefits of participation in a physical fitness training program, then, are viewed as having applicability not only to oneself, but also to families and to the larger law enforcement community.

The various psychological analysis carried out throughout the twenty-week exercise program revealed that with the exception of perceived physical ability improvement, alterations in psychological states and traits did not occur. However, when officers scoring in the extremes for various variables, such as anxiety, were evaluated, it was noted that significant alterations did occur. For example, both state and trait anxiety decreased in high-anxious officers across 10 weeks of training, whereas, low-anxious officers in the various exercise groups and sedentary control group officers remained unchanged. Therefore, anxiety was reduced in participants who scored high on anxiety from the outset, and this supports the common view held in the exercise sciences that such an intervention is efficacious in the management of anxiety and depression.

Adherence:

One of the major difficulties encountered in the experimental studies was the substantial number of volunteers who withdrew from the training programs. Because of the inadequate adherence rate, only six of the original ten groups of officers were considered in the analysis of psychological aspects of physical fitness training. The adherence rates ranged from a low of 29 percent for the interval group to a high of 61 percent for older officers in the supervised training group. The mean adherence rate was 4[illegible] percent, and this is considered excessive for studies of this nature.

As mentioned earlier, one of the objectives of this study was to determine what factors influenced an individual's decision to participate in a fitness program. Prior to the initiation of the study and again at the tenth and twentieth week, participating officers completed a Physical Estimation Attraction Scale which in part is designed to measure an individual's attitude toward physical activity. This permitted a comparison to be made of the dropouts and those who continued in the study. The result of this finding was somewhat surprising since one would expect the adherence group to possess more favorable attitudes toward physical activity from the outset. However, the initial mean values were nearly identical. In other words, the dropouts apparently decided to discontinue for reasons other than attraction toward physical activity. Therefore, attitude toward physical activity is of little use in predicting adherence or mortality in this particular study.

In order to evaluate factors associated with the high attrition rates, a questionnaire was mailed to all officers who dropped out of the program. An analysis was conducted to determine if there were any common contributing factors.

The major factor indicated for the high attrition rate was "the program required too much time." The officers also stated that they were holding second jobs, attending school, distance to the exercise facility, family and personal interest, court appearances, and injuries. These answers were somewhat perplexing since a similar number of officers who completed the program also held second jobs, attended school, traveled comparable distances, and experienced some injuries. Therefore, personal interviews were conducted with many of the dropouts.

The majority of the officers interviewed indicated that one major factor which led to their disillusionment was the experimental nature of the exercise groups. If an exercise session was missed during one week, the officers were asked to make up the session. During the course of the project, some officers fell so far behind in the required number of sessions that they felt it was easier to drop out than continue. Another factor contributing to disillusionment was loss of interest. Many officers felt that once they began the program they would feel better almost immediately. When they realized that progress was slow and the exercise session required work they became less enthusiastic and eventually lost interest entirely.

Perhaps the greatest problem was the voluntary nature of the experimental program. Although project personnel realize that selection of participants from volunteers is not an ideal method of conducting experiments of this nature, other considerations, such as location, time, and monetary restraints dictated the utilization of volunteer participants. Consequently, officers did not have departmental pressures to continue in the program. Some officers did not like the exercise programs in which they were placed. Others objected to exercise leaders who insisted they increase their maximum outputs when the participant did not feel he was capable of running longer distances or increasing the pace. The volunteer then felt as if he was being used only to prove a point and, subsequently, dropped out. Although the dropouts indicated in their questionnaire that there was sufficient communication and instruction from exercise staff, the personal interviews indicated that this was not always the case.

As a result of the dropout analysis, it became apparent that one major challenge concerned the necessity of devising strategies which will promote adherence and prevent attrition in fitness programs.

Physical Fitness Programs in State and Local Police Agencies

Another of the major areas of investigation in this project concerned the types of physical fitness and conditioning programs employed by police departments throughout the country. This task was accomplished by means of a survey of randomly selected police agencies.

To facilitate responses to the survey instrument, a series of screening questions concerning the presence or absence of a variety of fitness-related programs were asked.

In a general sense, one of the most telling facts was revealed by the responses to the screening questions. Most of the responding agencies have no physical fitness programs for current police officers. Of the 302 agencies which responded, only 43 departments reported they conducted any type of physical fitness programs. In fact, over 50 percent of the responding agencies provide none of the four types of programs of particular interest to this project, i.e., physical fitness training programs, weight maintenance programs, periodic medical examinations, and periodic physical performance tests. The most widely reported type of program reported was individual/team sports. While sports are certainly a popular form of physical activity, they are of limited value in terms of specific medical/physical conditioning.

It is clear, too, that agencies place much greater emphasis on evaluation of physical and medical condition of applicants than on similar evaluations of in-service personnel. Entrance level medical and physical performance tests are administered by at least twice as many agencies as provide similar tests to in-service police officers. In addition, although nearly all agencies require recruit training, not all of these recruit programs include specific physical fitness training. This declining emphasis on physical condition was further demonstrated by the responses to those items addressing performance evaluation. Results here suggested that, while probationary officers may face specific evaluative methods and administrative actions, in-service police officers face little more than the observational impressions of their supervisors.

The agencies providing various types of physical fitness programs usually do not evaluate program effectiveness or job-relatedness. Without follow-up evaluations of current programs, little progress can be made in the development of better programs for the future. It is not surprising that entrance level physical performance tests have been examined most often; these tests have recently been subjected to legal scrutiny in many jurisdictions.

Turning to the specific programs identified, further conclusions seem warranted. Physical fitness training programs, both existing and discontinued, were implemented primarily through administrative decision-making processes; pre-establishment feasibility studies were not conducted. Further reliance upon in-house resources is evidenced by the lack of assistance received in developing programs, as well as by the utilization of departmental facilities and personnel in administering these programs. Most programs emphasize running and weight-training; they are voluntary rather than mandatory, and not many officers participate. The majority of problems occurring in existing programs are the same as those which resulted in discontinuing similar programs in other agencies.

Weight maintenance programs, on the other hand, are more often mandatory. These programs usually require annual or semi-annual weigh-ins.

Periodic medical examinations and physical performance tests are also mandatory, but they are frequently required only at the time of promotion, and apply to limited numbers of personnel in each agency.

Of all the data collected in this survey, perhaps the most compelling are the statistics concerning loss of personnel. While not overwhelming, these data are at least suggestive of an existing problem in relation to physical fitness of police officers. The number of medical/health caused deaths far exceeded the number of accidental deaths in the sample. In addition, major causes of both early retirement and limited duty assignment were back trouble and heart-related conditions. Furthermore, all of these eventualities affected officers of all ages. Therefore, it cannot be concluded that physical fitness should be of greater concern to older officers than to younger ones.

One indication of an increasing awareness of the need for physical fitness training is the number of agencies that indicated they are currently developing programs. Although a number of agencies reported developmental efforts, it can be concluded that the need for programs is still great.

Site Visits

During the planning stages of this project, it was determined that considerable information and insight could be gained by visiting departments which conducted physical fitness programs. The main objective of this phase of the project was to glean information relative to the establishment, administration, and operation of these programs.

The selection of the agencies to be visited was determined by size, jurisdiction, and geographic location. As returns were received, it was noted which departments had physical fitness programs, had discontinued such programs, conducted mandatory weight maintenance programs, or required all sworn personnel to qualify annually in a physical agility examination.

Although this phase of the project did produce some enlightenment, much of the information was of a negative nature. Kansas City, Missouri, San Francisco, California, Colorado Springs, Colorado, and Lynchburg, Virginia, provided useful input. However, we discovered that many agencies report mandatory programs when, in fact, they only have mandatory testing.

Most of the departments which were visited were greatly concerned with physical ability performance for entry level personnel, and most were devoting time and personnel to this facet of fitness. We discovered a very broad base of interest in physical fitness programs. This interest, however, is hampered with issues such as necessary funds, time, facilities, and personnel.

We discovered three basic administrative approaches to physical fitness programs: The most common method is voluntary.

Voluntary Approach

The department provides exercise equipment, and through inter-departmental memos encourage their officers to keep in shape. Although the most widely used approach, it appears to be the least effective.

Revolutionary Approach

The administration indicates that officers will meet certain criteria within specified times to show they are capable to perform their duties. Failure to comply with the requirements within specified periods of time result in a negative disciplinary action. Usually no assistance is offered and there is no regular program for the officers to maintain their conditioning.

Evolutionary Approach

With this method, officers receive indoctrination concerning the program, testing to determine their current status, and assistance in meeting the requirements. After a time when all personnel have had the opportunity to comply, the program becomes one of mandatory compliance. This method is the most effective and creates less friction with members of the department and with collective bargaining groups.

Police agencies continue to recruit physically capable personnel. Their training programs are likely to include regular physical conditioning. However, once transferred to a regular assignment, the majority of departments do not require their officers to remain physically fit. Weight maintenance is more frequently employed than fitness programs. They are easier to administer and require less time and personnel.

The most important finding from the site visits is that in those agencies with physical fitness programs that are employing some success, the chief administrator and his staff are actively engaged in the program. The involvement of the department's leaders cannot be overemphasized. A chief administrator who complies with weight and conditioning requirements, and requires his command staff to conform, has much greater success and participation from line personnel. As with any program, the leadership displayed is responsible for the success or lack of support for the program.

Recommendations

Based upon the information gathered during our research, we recommend that departments desiring to implement fitness programs begin with an evaluation of the current fitness levels of their officers. Part II of the manual provides information for medical screening and fitness evaluation. Once the current condition of personnel is determined, programs can be implemented for officers to reach desired levels of performance. There is a definite need for a preventive medicine program for police officers of all ages. Educational information on good health habits, exercise programs, and proper diet is required. The needs of young and middle-aged officers clearly differ. The patrolman needs adequate strength and endurance to meet the physical challenges presented during his daily tasks. A combination weight training and running program is recommended for patrol officers. On the other hand, the needs of the middle-aged, executive police officer fall more into the preventive health category. A general aerobics program is recommended for them to reduce the risk of coronary heart disease and improve total health.

Where facilities, equipment, and budgets are limited, it is recommended that a program similar to the low-budget programs described in this manual be implemented. Extensive facilities, equipment, and budgets are not needed to successfully test physical fitness and implement a fitness program. Where facilities, equipment, and budgets are relatively unlimited, a combination of weight training and continuous running is recommended for police officers to improve both strength and cardiovascular-respiratory fitness.

If continual supervision of exercise is not available, it is recommended that complete indoctrination of exercise principles and practices be conducted before an individual is released to his own personal program. Part II of this manual provides information concerning various exercise regimens which may be utilized for officers of all age groups.

Throughout the course of our investigations and research, we found that the interest in physical fitness programs was quite intense. Many departments have contacted us regarding this subject. Perhaps the most frequently asked question is, "Where can I obtain a valid physical ability performance test for entry-level personnel?" This, of course, was not one of our objectives in this research, but should be considered as subject material for another project.

While many questions still remain unanswered, it is our intention and hope that this manual will provide the administrator with the information necessary to initiate physical fitness programs in his agency.

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CHAPTER I

PRINCIPLES OF EXERCISE: A LITERATURE REVIEW

A general understanding of the principles of exercise and terminology used throughout this manual is desirable. The information in this chapter will enhance the understanding of exercise and prepare the reader for the following chapters.

Cardiorespiratory Fitness

The overall determinant of endurance fitness is the ability of the body to transport oxygen from the atmosphere to the sites of biochemical activity in the working muscle. Aerobic capacity or maximum oxygen intake (VO_2 max) is the parameter commonly used to evaluate the oxygen transport system of the body. Improvement in cardiorespiratory or endurance fitness is dependent upon the total work or energy cost of the exercise program. Energy cost can be measured by the number of calories expended and is dependent upon the intensity, duration, and frequency of the exercise program. In addition, improvement is related to the initial level of fitness, status of health, mode of exercise, regularity of exercise, and age. These factors should be considered in designing an exercise program to meet the needs, interests, and abilities of the police personnel involved in training regimens. How much exercise is needed and how much each of these factors contributes has been the topic of many studies (18,28,31,32,35,46, 52,56,74,77,78,87,88). These factors will be discussed in relation to changes in VO_2 max, body composition, and resting heart rate. Results concerning other changes in cardiorespiratory parameters are discussed elsewhere (56).

Intensity

Improvement in cardiorespiratory fitness is relative to the level of energy expenditure per minute or intensity of training. Because of the linear relationship between heart rate and oxygen intake, intensity can be expressed as either percentage of maximum heart rate or VO_2 max *(See Figure 1.1)*.

A certain level of intensity is required to elicit improvements in aerobic capacity. This level is generally referred to as threshold of intensity. The threshold varies according to age, level of fitness, health, etc. In general, however, activities low in intensity or energy expenditure such as golf, bowling, and other game activities which are too intermittent, show little or no improvement in cardiorespiratory function, whereas, excellent improvements result from moderate to high intensity activities such as running, fast walking, bicycling, and swimming.

Many studies have been conducted to determine the threshold of intensity. Karvonen et al. (35) found no significant improvement in VO_2 max in a group of young men trained below 135 beats/min., but the group whose sustained heart rate was above 153 beats/min. improved significantly. Hollmann and Venrath (32), in a similar study conducted on a bicycle ergometer, found that heart rate values of 130 beats/min. or more were needed to stimulate a cardiorespiratory improvement. The data suggest that the threshold level for young men is at a heart rate equal to approximately 60 percent of their maximum heart rate.

In addition, a positive relationship exists between intensity of training and improvement in VO_2 max. Sharkey and Holleman (75) walked young men on a treadmill three times per week for six weeks at heart rates of 120, 150, and 180 beats/min., and found a direct relationship between the magnitude of improvement in VO_2 max and intensity of training. Gledhill and Eynon (28) further substantiated the value of intensity as a stimulus for eliciting a training

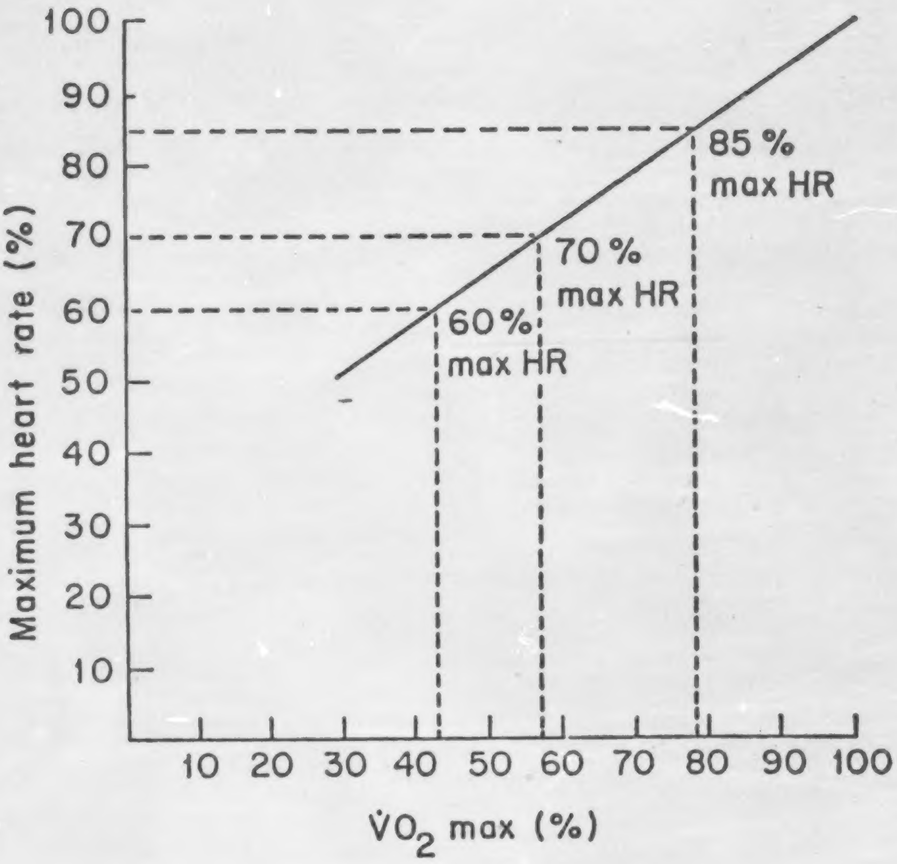

Figure 1.1 The relationship between percentages of maximum heart rate and oxygen intake ($\dot{V}O_2$ max).

effect by training 36 college students on bicycle ergometers for 20 mins., five days per week, for five weeks. The subjects maintained heart rates of 120, 135, or 150 beats/min. All groups improved in VO_2 max, maximum performance, and heart rate at a workload of 1500 kpm/min. When the groups were subdivided into low and high fitness levels, the high fitness group showed no improvement in VO_2 max and performance time at training heart rates of 120/beats/min., while the low fitness group did improve, emphasizing that training stimulus threshold has a wide range and is dependent on initial level of fitness. Thus, some improvement can be expected for low fitness groups who exercise at heart rates as low as 120/beats/min. More physically fit individuals usually must train harder to elicit improvement.

Duration

Duration is the amount of time that the prescribed intensity load should be performed to elicit the desired training response and, thus, is highly interrelated with intensity. Usually high intensity programs are of shorter duration and low to moderate intensity programs are of longer duration.

Improvements in VO_2 max have been found with programs of very short duration. Shephard (77) found improvements in VO_2 max after a training program which lasted only ten minutes per day and Hollmann and Venrath (32) found improvements in ten subjects who did stationary running ten minutes per day.

Several investigations have shown a significant relationship between duration of training and magnitude of improvement in VO_2 max. Olree et al. (52) trained young men for 20, 40, or 60 minutes on a bicycle ergometer and found the longer duration programs to produce significantly more improvements.

Wilmore et al. (87) conducted a jogging program for middle-aged men. Each group exercised 12 or 24 minutes per day, three times per week for ten weeks. Both groups improved significantly in VO_2 max with the 24-minute group showing more improvement than the 12-minute group. Recently, Milesis et al. (46) trained men for 15, 30, or 45 minutes per day, three days per week at 85 to 90 percent of maximum. Figure 1.2 shows that all three exercise groups improved significantly in VO_2 max with the magnitude of improvement related to duration of exercise. Yeager and Brynteson (89) trained young women on a bicycle ergometer for 10, 20, or 30 minutes per day, three days per week for six weeks and found similar results.

Sharkey (74) studied the interaction of intensity and duration of training on the development of cardiorespiratory endurance. Thirty-six college men were randomly assigned to programs which included three levels of training intensity (130, 150, and 170 beats/minute) and two levels of duration (7,500 and 15,000 kpm total work). The subjects trained on bicycle ergometers three days per week for six weeks. No significant intensity, duration, or interaction effects were revealed, possibly due to the fact that all groups performed exactly the same amount of work, thus showing the importance that total work output has on developing fitness.

Shephard (77) investigated various combinations of intensity, duration, and frequency. A group of 39 sedentary men trained at 96, 79, and 39 percent of VO_2 max; five, three, and one days per week, for 20, 10, and 5 minutes per session for ten sessions. The results indicated that the main factor influencing the extent of training achieved was the intensity of effort relative to the subject's initial VO_2 max. Improvement was also influenced by the frequency of exercise and marginally by its duration. The most effective regime involved the combination

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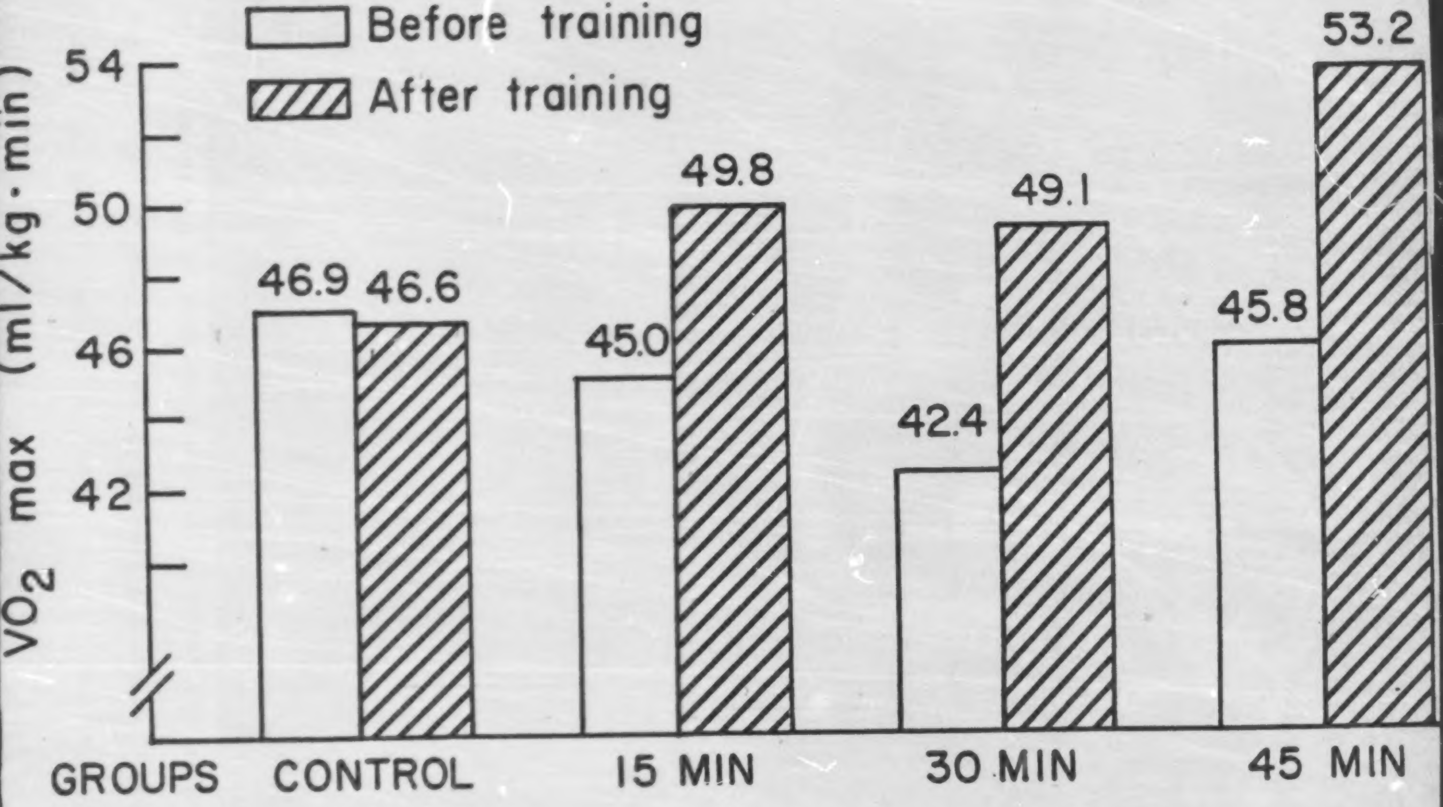

Figure 1.2. Effects of training duration on maximum oxygen intake ($\dot{V}O_2$ max) (46)

of maximum intensity, frequency, and duration of exercise.

Davies and Knibbs (18) trained young men at 80, 50, and 30 percent of VO_2 max for eight weeks. Their results agreed with those of Shephard (77) in that greater improvement in VO_2 max was achieved with the higher intensity programs. The groups working at or below 50 percent of VO_2 max did not improve significantly.

Pollock *et al*. (58) trained 2 groups of men 45 min/day, two days per week, at 80 and 90 percent of maximum heart rate for 20 weeks. To equalize the total energy cost between the two groups, the 80 percent group exercised for a longer duration. Both groups improved significantly in cardiorespiratory function, but differences in intensity had little effect indicating that lower intensity work may achieve a similar result as higher intensity work if the total work or energy cost is equalized.

Frequency

How often one should train is dependent upon the needs and goals of that individual. Many athletes train twice a day, but exercising that often is not necessary for most individuals to reach an optimal level of fitness. Numerous studies have sought to evaluate frequency of training by attempting to control the number of total training sessions in various programs and/or total work output. These investigations generally show no difference in improvement with frequency of training.

Hill (31) trained 24 men, 20 to 44 years of age for three or five days per week. At the end of eight weeks both groups were reevaluated and showed a significant improvement in VO_2 max. At this stage of the experiment, the five days per week group showed significantly more improvement. In an attempt to equalize total training sessions, the three days per week group continued to train another five weeks while the five day group stopped. Upon completion of this segment of training, the three day group's data equalled that of the five day group's program at the end of their eight weeks. Sidney _et al_. (78) found similar results for groups training two or four days per week when total work was held constant. Another group training just one day per week showed little advantage over no training at all.

Because exercise should not terminate after a few weeks, but continue throughout life, frequency of training should be evaluated by equalizing the total number of weeks, not the total number of workouts. When weeks of training were held constant instead of total number of exercise sessions, results generally showed improvements in VO_2 max with higher frequencies of training (59,62,63,67).

Pollock _et al_. (63) compared results of six running programs conducted two, three, or four days per week for 20 weeks. As shown in Table 1.1, the four days per week groups showed significantly more improvement than two and three days per week groups. There was no significant difference between the two and three days per week groups in improvement of VO_2 max. A more recent investigation completed by Pollock _et al_. (unpublished data) showed a three days per week program to have a greater improvement in VO_2 max if compared to the two days per week groups in Table 1.1.

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TABLE 1.1 Cardiorespiratory results of running frequency

Frequency (Days/Week)	VO_2 max (% Improved)	Resting Heart Rate (% Improved)
Control	0.0%	0.0%
2 days	17.0%	8.6%
3 days	16.0%	11.1%
4 days	22.0%	11.9%

Data on 148 previously sedentary men, ages 28-64. Subjects ran 30 to 45 minutes a day for 20 weeks (63).

Gettman et al. (27) trained men 20 to 35 years of age; one, three, or five days per week, 30 minutes per day for 20 weeks. Figure 1.3 shows significant improvements in VO_2 max in direct proportion to frequency of training. The resting heart rate values showed the same relationship.

Thus, it can be concluded that exercising only one day per week shows minimal improvements in cardiorespiratory fitness. Two and three day programs elicit moderate improvements, while four and five day programs show a more significant improvement. Using this information, programs which emphasize exercising three to five times per week are recommended.

Regularity of Training

Closely related to frequency of training is the consistency of training and its subsequent effect on cardiorespiratory function. Cureton and Phillips (17), using equal eight-week periods of training, nontraining, and retraining, found significant improvement, decrement, and improvement, respectively, in cardiorespiratory efficiency. Michael and Gallon (45) and Fardy (26) followed the training of college basketball and soccer players over the course of a

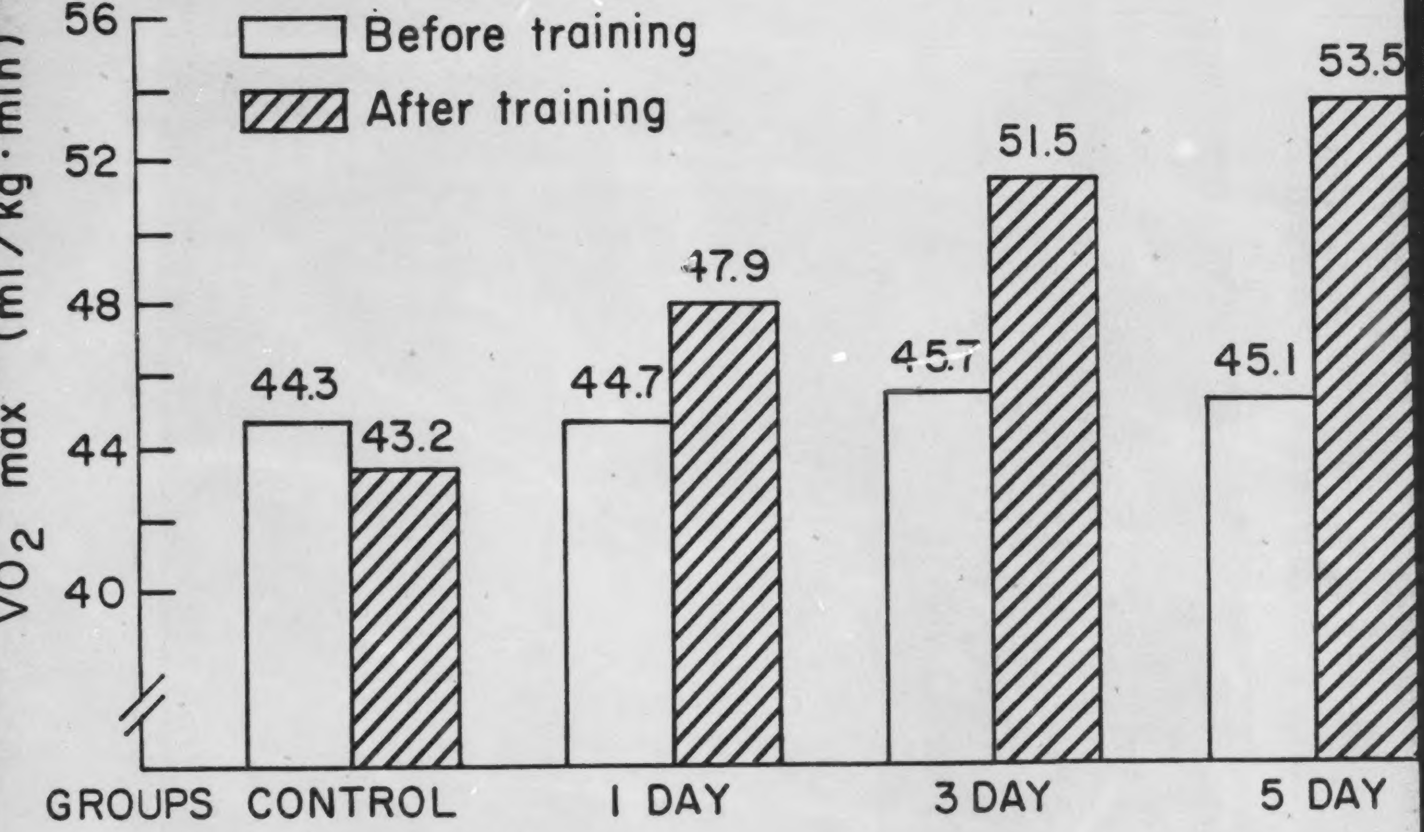


Figure 1.3. Effects of training frequency on maximum oxygen intake ($\dot{V}O_2$ max) (27)

season, with subsequent periods of nontraining. Both groups of athletes showed increases in efficiency during the season, followed by significant reductions during the nontraining period. Williams and Edwards (84) found similar results when studying the effect of variant training regimens on cardiorespiratory efficiency of young college men. Drinkwater and Horvath (21) studied female high school track athletes and found that after three months of nontraining, the cardiorespiratory fitness of the athletes decreased to the level of nonathletic girls of similar age.

Bed rest studies have shown decrements in physical working capacity and related cardiorespiratory parameters. Saltin _et al_. (72) confined five subjects to bed for 20 days, followed by a 60-day training period. Cardiorespiratory efficiency values decreased during bed rest and improved steadily with training. Heart rate response to a submaximal test increased up to 30 beats/minute after bed rest and decreased significantly with training.

Roskamm (71) trained 18 subjects daily for four weeks and showed a 20 percent increase in cardiorespiratory fitness. At this point one group (Group I) continued training every third day and the other group (Group II) stopped training. Group I maintained their level of fitness while Group II began to lose their level of working performance within two weeks (see Figure 1.4). It is apparent from this review that training effects are both gained or lost rather quickly, and regular, continual stimulation is necessary to maintain cardiorespiratory efficiency.

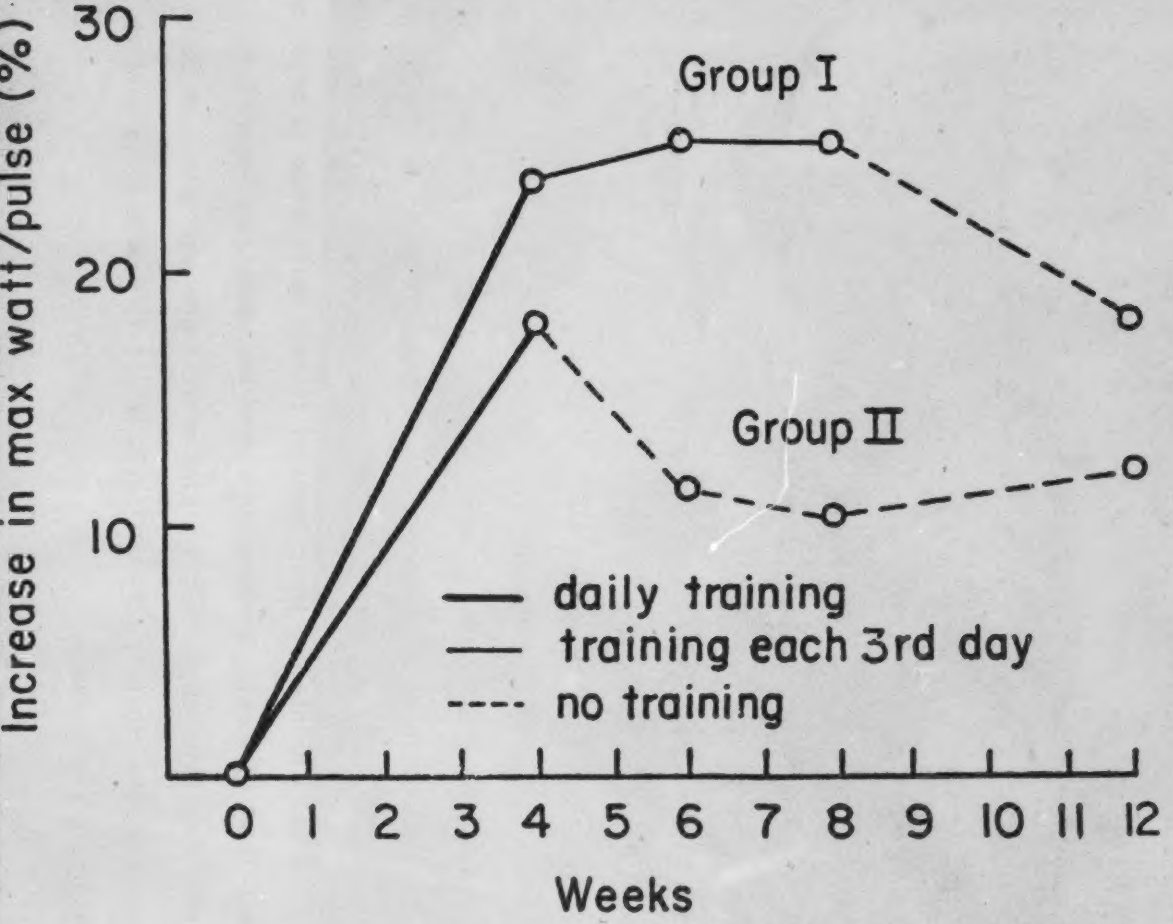


Figure 1.4 Increase in maximum watt/pulse compared with the initial value (71)

Maintenance of Fitness

Once an optimal level of fitness is reached, programs of lower frequency, intensity, or duration may be initiated to maintain a certain level of fitness. Roskamm (71) in the investigation reviewed above found that training every third day was enough to maintain cardiorespiratory fitness. Kendrick et al. (38), in an attempt to determine the effects of different magnitudes of nontraining, reevaluated 22 middle-aged men after a 12-week nontraining period. Subjects originally trained eight miles per week for 20 weeks, and were subsequently divided into the following three subgroups: group A continued to train eight miles per week, group B trained three miles per week, and group C was inactive. The results showed group A to maintain and/or improve their level of efficiency, while groups B and C regressed significantly. Group C lost approximately 50 percent of its original improvement. Siegel et al. (79) trained nine sedentary middle-aged men 12 minutes, three days per week for 15 weeks and found an increase in VO_2 max of 19 percent. After completion of the program, five subjects continued to train once a week for another 14-week period. At this time their VO_2 max had decreased to six percent above the initial control level. The remaining four subjects who abstained from training fell below their original control values. Kilbom (39), in a review of how physical fitness can be maintained, recommended that exercising at least two days per week if preferable.

Pollock et al. (57) in an effort to determine if cardiorespiratory fitness can be maintained through an exercise regimen of decreased intensity and increased duration trained 14 men for 30 minutes three days per week, for 20 weeks at a high intensity (94 percent of maximum heart rate - 179 beats/minute) followed by six weeks of lower intensity work (84 percent of maximum heart rate - 166 beats/minute). Five of the 14 subjects stopped training during the last six weeks. The energy cost of the two phases was equalized by extending the duration of training during the latter six week period. The subjects improved significantly in VO_2 max during the first 20 weeks. The nine subjects who continued training, but at a lower intensity for the six additional weeks maintained the level of fitness achieved during the first 20 weeks, but the five subjects who stopped training during the last six weeks decreased significantly (see Figure 1.5). This study supported the concept that cardiorespiratory fitness can be maintained by decreasing intensity and increasing the duration sufficiently to equalize the total calorie expenditure.

Modes of Training

Previous sections of this review have been concerned primarily with endurance activities such as running and cycling. However, other activities such as walking, swimming, skiing, dancing, and sports of varying degrees of intensity and aerobic demand may improve cardiorespiratory fitness. Many investigators have sought to determine the relative value of these other activities as well as jogging and cycling in producing cardiorespiratory fitness changes. As previously shown, certain quantities and combinations of intensity, duration, and frequency are necessary to produce and maintain a training effect.

In addition, the total amount of work or energy cost of an activity is an important consideration. Theoretically, the training effect should occur equally if these factors are held constant. To investigate this, Corbin et al. (15)

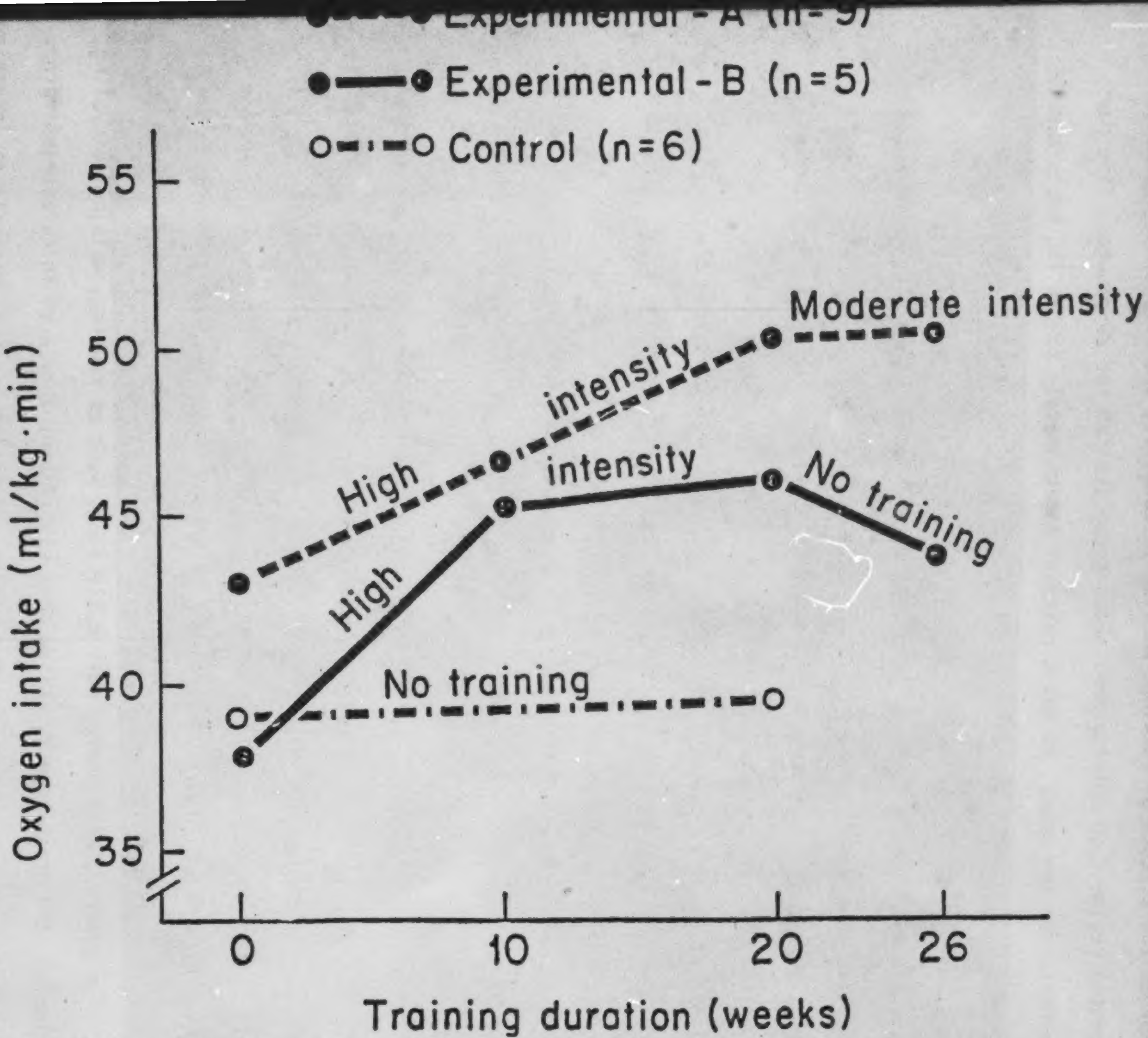


Figure 1.5 Effects of high intensity (94% max HR) followed by moderate intensity (84% max HR training on the development and maintenance of maximum oxygen intake (57).

compared the effects of running, walking (treadmill), and bicycling (ergometer) training regimens on college men. Each group trained for 20 minutes, five days per week, for ten weeks, at heart rates of approximately 150 to 160 beats/minute. In general, they found running and bicycling to be superior training modes when compared to walking. Pollock et al. (61), Figure 1.6, in a similar experiment conducted with middle-aged men, found all three modes of training to be equally effective in producing a significant cardiorespiratory improvement. In this study, the subjects trained for 30 minutes, three days per week, for 20 weeks, at 85 to 90 percent of maximum heart rate (approximately 175 beats/minute). Wilmore et al. (86) compared the effect on aerobic capacity of tennis, bicycling, and jogging. Each group exercised three days/week for 45 min/day for 20 weeks at approximately 85 percent of maximum heart rate or 75 percent of VO_2 max. All three groups improved significantly in cardiorespiratory fitness (jogging - 14.8%, bicycling - 13.3%, and tennis - 5.7%) with the jogging and bicycling groups improving substantially more than the tennis group.

Some people cannot exercise in the conventional manner of walking and running due to illness, injury, orthopedic problems, etc. Thus, exercise programs must be adjusted to meet these special needs. Pollock et al. (64) conducted a study with eight sedentary disabled men and 11 sedentary normal men and found that cardiorespiratory improvement could be achieved through arm pedalling on a modified bicycle ergometer.

In general, high energy cost activities, such as running, walking, bicycling, swimming, and cross-country skiing show significant increases in cardiorespiratory efficiency. In contrast, low energy cost activities, such as moderate calisthenics, golf, and various organized game activities show little or no effect. Although

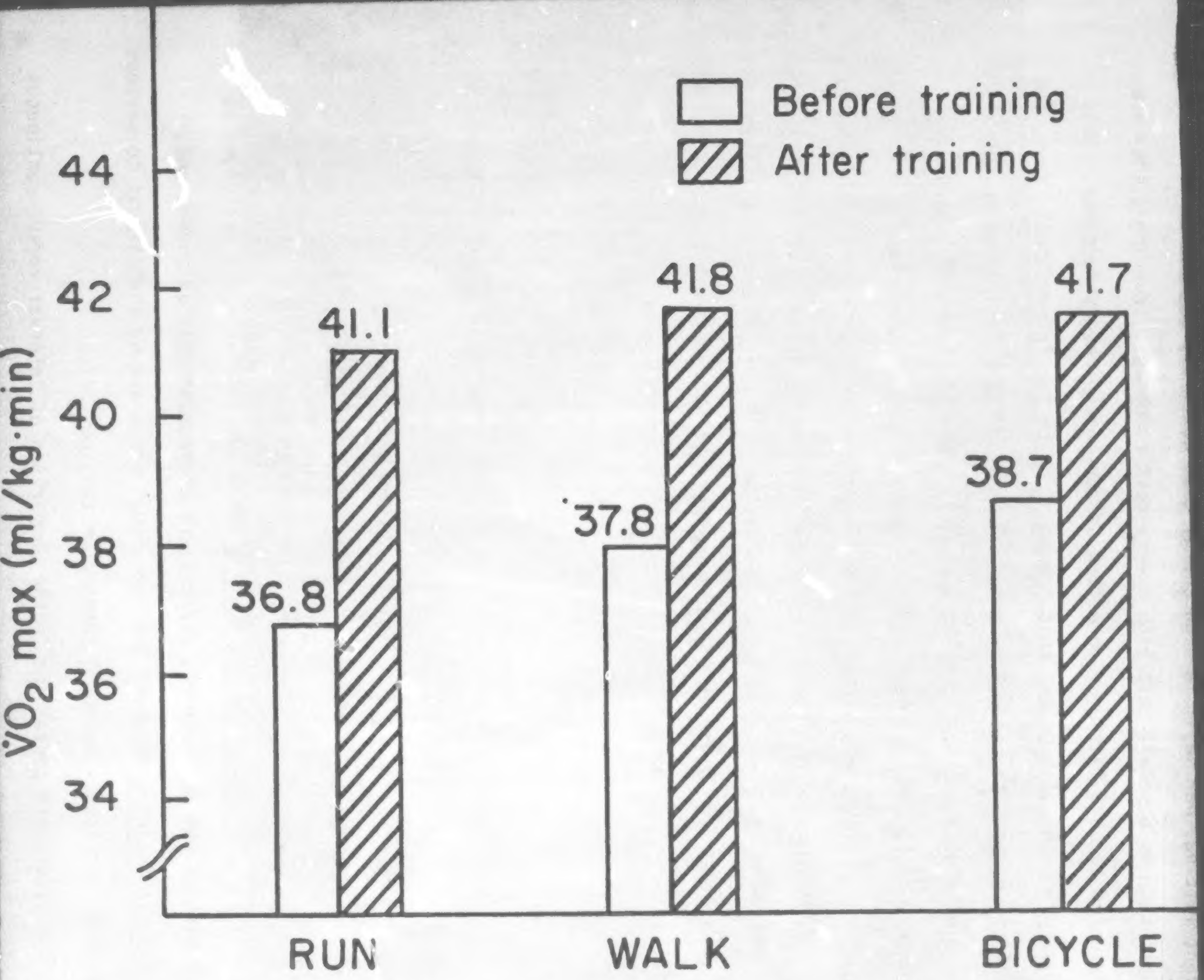


Figure 1.6. Effect of training mode on maximum oxygen intake ($\dot{V}O_2$ max) (61)

weight lifting, per se, is a high energy cost activity, and phases of other sports such as baseball have high energy cost components (running), they are considered to have little or no effect on cardiorespiratory function. This results from the high energy cost component being too intermittent; thus, the total energy cost of the activity in relation to total time would be considered quite low. Other activities (55) producing significant cardiorespiratory effects include dancing, rope skipping, tennis, soccer, basketball, wrestling, football, handball, and a combination of sport activities and running. Cooper (13, 14) has emphasized the concept regarding the variety of modes of training for eliciting a training response. He devised a system whereby activities are given point values in respect to their energy cost, thus a variety of activities may be interchanged within a fitness training program.

Types of Training Programs - Interval vs Continuous

Shephard lists four distinct types of training programs (76). These are: (1) Continuous Running in which the individual exercises at a moderate and relatively steady intensity for long periods (ranging from fifteen minutes to several hours); (2) Brief-interval Running in which the individual undertakes short bursts of maximum activity (approximately 30 sec. to 1 min.), interspersed with recovery periods of corresponding length when only light activity is allowed; (3) Prolonged-interval Running where the intervals are prolonged to 2 1/2 minutes and the recovery periods are correspondingly extended; and, (4) Circuit Training in which the individual moves around the circuit to various gymnasium exercises - pushups, running on the spot, etc.

The literature pertaining to the comparison of interval versus continuous running programs reveals conflicting results. To date, there is no good scientific evidence supporting one program over the other.

Initial Level of Fitness

The concept of percentage of improvement attained in certain physical fitness parameters being related to one's initial level of fitness was proposed in the early work of Muller (49). He conducted a series of experiments dealing with the improvement in strength and concluded that the percentage of improvement was directly related to initial strength and its relative distance from a proposed level of improvement. This concept has also been true in training studies dealing with cardiorespiratory parameters. Sharkey (74) noted that the magnitude of change was inversely related to the initial level of fitness.

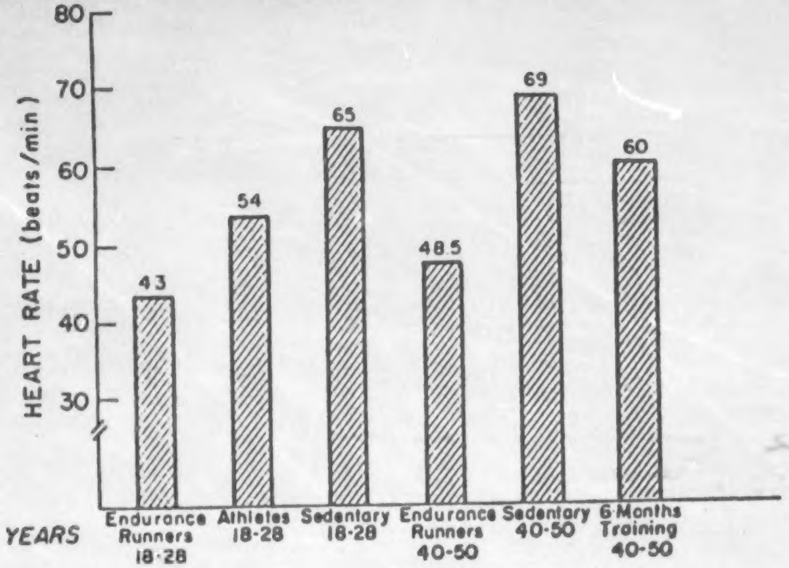
Resting heart rate is reduced with training, with the magnitude of change dependent on the initial level. Most studies show a reduction in resting heart rate to the mid to lower 60's. The data for endurance athletes show average resting heart rates 10 to 15 beats/minute lower than for the moderately trained groups, although it is not clear whether this difference may be due to genetic factors, training, or both.

Age

Longitudinal and cross-sectional studies indicate that cardiorespiratory function decreases with age. Robinson (69) showed that men tend to peak in aerobic capacity between 17 and 20 years of age and steadily decrease over the subsequent years. At age 75, aerobic capacity is less than 50 percent of the original peak value. Robinson et al. (70) measured VO_2 max on a group of subjects at age 18 to 22 years; then again at ages 40 to 44 and 49 to 53 years. At age 40 to 44, VO_2 max had declined 25 percent, and had continued to decrease when reevaluated at age 49 to 53. Skinner (80) has suggested an approximate 21 to 30 percent decrease in VO_2 max over a 30 to 40 year range.

Many researchers have tried to determine if aging affects the trainability of persons as they get older. Saltin et al. (73) found improvement in VO_2 max at ages 29 to 63 and concluded that although a training effect occurs as readily in middle-aged and old men as in young, the absolute change is less. Therefore, there appears to be some aging effect. Pollock et al. (60) trained 22 men, aged 49 to 65 years in a walk-jog program 30 minutes, three days per week for 20 weeks and found an 18 percent increase in VO_2 max. These results are in agreement with those of Kasch et al. (36) with middle-aged men, 39-60 years. Benestad (3) found no change in cardiorespiratory function in older subjects who trained daily for five to six weeks. deVries (19) found improvements in subjects aged 52 to 88 years who participated in a low intensity exercise program, but the relative change was considered less when compared to younger subjects. Tzankoff et al. (82) found significant improvements in VO_2 max with men aged 44-66 years.

The aerobic capacity of middle-aged and older endurance athletes is markedly superior in every age category to that of untrained individuals. Figure 1.7 shows the differences in VO_2 max and resting heart rate among different athletes and sedentary men (55). The age reduction mentioned earlier also appears in the trained groups and becomes particularly evident after age 60. Can this reduction in VO_2 max be explained by age itself or are training factors also apparent? The evidence at hand supports both concepts. Young endurance runners will train 100 to 200 miles per week (sometimes less if purely interval training is used); whereas the middle-aged and older runners rarely accomplish this. In data collected from the 1971 National Master's AAU track and field meet and subsequent laboratory evaluations conducted by Pollock, Miller, and



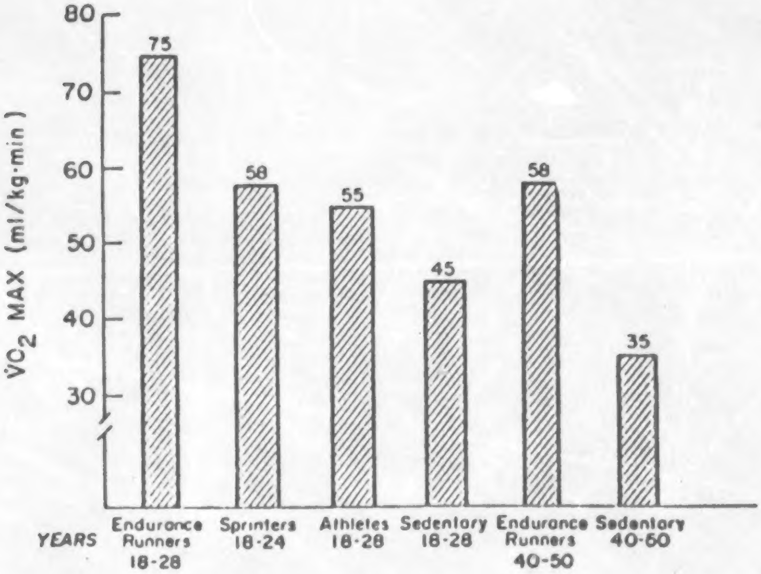


Figure 1.7 Comparison of resting heart rate and maximum oxygen intake ($\dot{V}O_2$ max) among young and middle-aged men with various fitness levels (55)

Wilmore (66) the average number of miles trained per week was 40, 40, 30, and 20 for the fourth, fifth, sixth, and seventh decades, respectively. In addition, most of these men were prior college athletes, but had not trained all their lives. Most of the older athletes had been sedentary for many years and had been back in training for only five to ten years. Grimby's and Saltin's (29) data on middle-aged and older athletes who had trained all their lives show them to be above the aging curve in VO_2 max at all ages. Other data of Pollock _et al_. (65), on men who had been training for 5.5 years, show significantly higher VO_2 max values than for men completing their first six months of training, but these are lower than for the aforementioned athletic groups. With the increase in Master's competition and the probability of men and women training for competition throughout their lifetime, future data should provide more insight into the aging process and its effects on fitness parameters.

Environmental Factors

Heat

When exposed to heat or during muscular work, the heat content of the body tends to increase. When the total heat load of the body exceeds the limit of thermoregulatory compensation, various incapacities occur such as heat cramps, heat exhaustion, and heat stroke. Optimal function requires that the body temperature be maintained between 36.5 and 39.5°C. The capacity to perform physical work in the heat varies greatly among individuals. In general, the extent of the performance decrement is influenced by the capabilities and limitations of the individual, the level of thermal stress, and the specific demands of the task being performed. Caplan and Lindsay (10) found that in deep mine drilling operations, efficiency decreased 25 percent when the environmental heat load was increased from an effective temperature of 85°F to 91.5°F. At 96°F efficiency was 50 percent, and at 98.5°F output was reduced 75 percent. Brouha _et al_. (6, 7) observed a progressively increasing cardiac cost during work as the environmental temperature increased. For a 15-minute work and 20-minute recovery period, the total number of heart beats more than doubled when the thermal load was increased from an effective temperature of 75°F to 90°F.

Acclimatization to heat and physical training greatly enhances the ability to tolerate work in heat (8). Improvement in heat tolerance is associated with increased sweat production and a lowered skin and body temperature (88). The increased sweat rate provides the possibility for a more effective cooling of the skin through evaporative heat loss, and the resultant lowered skin temperature provides for a better cooling of the blood through the skin. Buskirk and Bass (8) list the following characteristics of heat acclimatization:

1) Heat acclimatization begins with the first exposure, progresses rapidly with subsequent exposure, and is well developed in about seven days.

2) It can be induced by short intermittent bouts of exercise in the heat, e.g., of from two to four hours daily.

3) Athletes in good physical condition acclimatize more rapidly than nonconditioned people and are capable of more work in the heat.

4) Daily work, if progressively increased in the heat, leads to early development of maximal performance capacity. Overexertion on the first exposure may result in disability, which in turn inhibits the acclimatization process.

5) Acclimatization to warm conditions will facilitate acclimatization to hot conditions but will not confer complete acclimatization to hot conditions. Acclimatization to hot conditions will facilitate performance under warm conditions.

6) The general pattern of acclimatization is similar for work of different intensity and duration.

7) Acclimatization to hot dry climates enhances performance capability in hot, wet climates and vice versa.

8) Inadequate water and salt replacement can retard the acclimatization process.

9) Acclimatization to heat is retained for about two weeks with no exposure. Thereafter, loss of acclimatization is highly individual. Athletes who stay in good physical condition should retain heat acclimatization best.

When exercising in hot and humid environments, certain precautions should be followed. Buskirk and Bass (8) and Murphy and Ashe (50) make the following recommendations:

1) Wear light, loose porous clothing.
2) Take adequate amounts of water and salt.
3) Exercise during the cool part of the day.
4) Allow at least two weeks for acclimatization.
5) Reduce work load during period of extreme thermal stress.

Cold

In general, few problems are posed by exercising in the cold other than the psychological disadvantage of being uncomfortable. When subjected to a cool environment, the first thermoregulatory response is a constriction of the skin blood vessels, thus reducing heat loss through the skin. As man becomes progressively colder, shivering is activated to increase metabolic heat production. Exercise further increases heat production and overrides the necessity to shiver. The combination of greatly increased heat production due to exercise and reduced heat loss due to excess clothing result in a positive heat load. Positive heat load can be reduced by removing layers of clothing during progressive exercise in the cold.

Altitude and Hypoxia

The Mexico Olympics in 1968 focused attention on the relationship between altitude (hypoxia) and physical performance. The Olympic stadium was 7,350 feet above sea level, with an average barometric pressure of 580 mmHg. The percentage composition of the atmosphere remains essentially unchanged over the range of altitudes and is approximately 20.93% oxygen, 0.03% carbon dioxide, and the balance nitrogen and other inert gases. There is a logarithmic decrement in the total ambient pressure with altitude, so that at eighteen thousand feet, the pressure is approximately halved (380 mmHg), and at 33,000 feet, it is only a little more than a quarter of the sea level reading (197 mmHg). This decline in total pressure reduces the partial pressure of oxygen in inspired gas. Within the alveoli, both water vapor and carbon dioxide remain at relatively fixed partial pressures (47 and 35-40 mmHg, respectively), and consequently the partial pressure of oxygen is reduced even more.

The reduced oxygen partial pressure in arterial blood decreases the quantity of oxygen transported to the working muscles, thus limiting the capacity for physical work. Maximal aerobic capacity shows a linear decrease with increasing altitude amounting to approximately 3.2 percent in unconditioned men and 1.9 percent for conditioned men for every 1000 feet above 5,000 feet (9).

It has been proposed that the change associated with conditioning, training, and acclimatization in altitude would enhance aerobic capacity and improve performance times at sea level. Faulkner et al. reported on three investigations (23,24) where, 1) five well-conditioned male runners trained for ten days at an elevation of 7872 ft.; 2) four well-conditioned male runners and one swimmer trained for 23 days at 7544 ft. elevation; and 3) 15 male college swimmers trained at the altitude of 7380 ft. for 14 days. These studies showed improved performance in two stages. The first improvement was observed after the first few days when the athlete had learned to adjust his pace to the new altitude conditions (acclimatization). The second improvement overlapped the first then tended to level off by the end of the second week. The amount of improvement in the second stage of adaptation appeared to depend in part on the degree to which the athlete was trained pre-altitude.

The compensatory mechanisms acquired in acclimatization to altitude are: 1) an increase in pulmonary ventilation; 2) an increased hemoglobin concentration in the blood; and 3) morphological and functional changes in the tissues (increased capillarization, myoglobin content, modified enzyme activity (2). The well-trained individual is not acclimatized to high altitude any sooner or any more effectively than the untrained individual.

Opinions differ concerning the question whether or not the performance capacity at sea level is improved following exposure to high altitude. Buskirk et al. (9) and Consolazio (12) state that their subjects who trained at high altitude for four weeks or more did not attain any better VO_2 max results than usual when they returned to sea level. Buskirk et al. (9) conclude that there is little evidence to indicate that performance on return from altitude is better than before going to high altitude, if training remains relatively constant.

When exercising at high altitude, a period of at least three weeks is necessary for acclimatization. There is no evidence to suggest that it is necessary to take it easy during the initial period of exposure to high altitude (2). However, due to the lower oxygen pressure, one is forced to accept a slower tempo, and the intensity and duration of training activities must be reduced.

Body Composition

Reduction in body weight and fat occurs in response to physical training and has been documented in numerous scientific investigations (5, 27,46,47,63). The principle involved in reducing body fat is based on the increased number of calories the body burns during physical training. Continuous, moderate, rhythmic type activities, like running, burn a large number of calories (54) and place the body into negative caloric balance, i.e., more calories are expended than are input. The end result is that the body utilizes its stores of fat to make up the deficit, hence a reduction in body fat (weight). About 3500 calories are contained in a pound of body fat; therefore, 3500 calories must be expended through exercise to lose a pound of fat. An individual can lose a pound of fat in less than 12 days by expending an extra 300 calories per day through exercise. The speed with which the exercise is performed determines the amount of time required per day to burn 300 calories. For example, a moderate jog for most people would expend about 10 calories per minute; therefore, jogging about 30 minutes would expend 300 calories.

Dieting alone is not an effective way to reduce fatness as is shown in several investigations (4, 53). Although dieting will cause a reduction in weight, 65 percent of the weight loss is from loss of muscle mass and only 35 percent from fat loss. Therefore, the percent body fat, which is the proportion of body weight that is fat tissue and is the true indicator of body leanness-fatness, can remain approximately the same in response to weight loss by dieting alone. In contrast, in exercise programs with food intake remaining constant, significant reductions in percent fat along with increases in muscle mass occur. The concurrent loss of fat and gain in muscle can balance each other and result in only a slight change in overall body weight, but a significant decrease in percent body fat. A calorie-restricted diet along with an exercise program is recommended when weight and fat reduction are desired.

The futility of diet alone is contrasted with the effectiveness of an exercise program in Figure 1.8. Several important points are noted therein (34). First, the sedentary free-eating animals, which represent the typical non-dieting, physically inactive American adult, were the heaviest and the fattest. Second, the sedentary paired-weight animals, which were physically inactive, but restricted in food to match the body weight of the runners, were considerably fatter than the runners even though the body weight for both groups was the same.

When comparing trained and untrained individuals with the same average heights and weights, a greater proportion of the weight of the physically active individual is in the form of lean tissue. Welham and Behnke (83) compared a

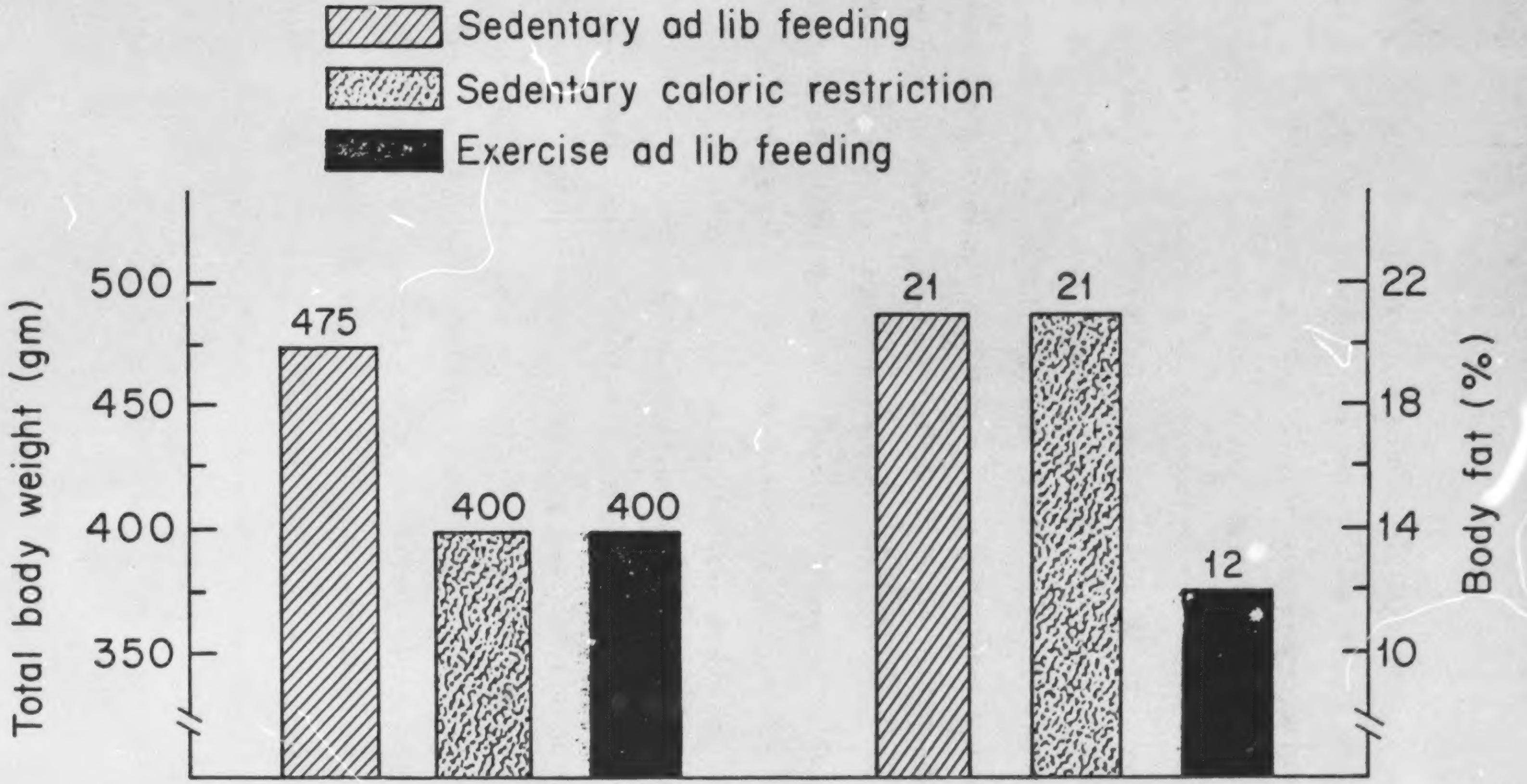


Figure 1.8. Effects of 15 weeks of daily exercise on body composition of adult male rats (34)

group of professional football players with a group of naval personnel and found that although the football players were heavier, most of them had less body fat than the naval personnel. Costill and Fox (16) measured six skinfold fat sites on a group of competitive marathon runners and on a group of college professors who were the same age and weight. The sedentary faculty men had more than twice as much fat (16.3%) as the athletes (7.5%). Pollock et al. (68) found similar results in a comparison between a group of world class distance runners and a group of sedentary men matched for age and body weight.

Because changes in body weight and body fat are related to energy expenditure of a program, the regimens with greater combinations of frequency, duration, and intensity tend to show greater magnitude of change. Pollock (55) compared body weight and fat of young and middle-aged men of various fitness levels. As Figure 1.9 shows, the men involved in the highest energy cost programs, endurance runners, had the lowest body weight and fat.

Pollock et al. (63) combined data from studies conducted on middle-aged men training two, three, and four days per week and found that exercising approximately 30 minutes two times per week was not sufficient to reduce body fat and weight. However, training three and four days per week for 30 minutes caused significant reductions in body weight and body fat. Skinner et al. (81) found that exercising a minimum of three times per week, approximately 40 minutes per session, for a period of six months was effective in decreasing body fat in sedentary middle-aged men. Milesis et al. (46) found body fat reductions in groups training 15, 30, and 45 minutes per day, three days per week for 20 weeks. Wilmore et al. (87) investigated the body composition changes with a ten-week jogging program on 55 men, aged 17 to 59. Small, but significant, reductions

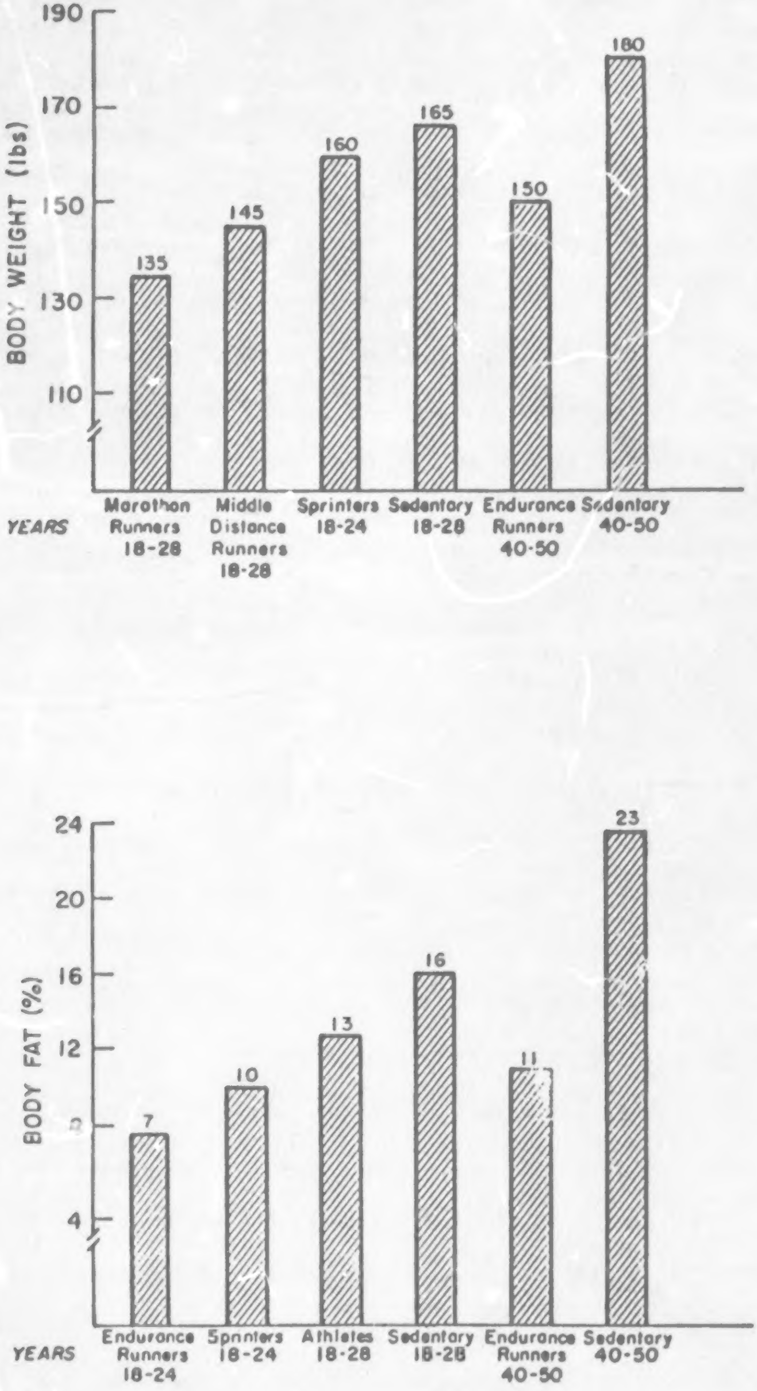


Figure 1.9 Comparison of body weight and fat among young and middle-aged men with various fitness levels (55)

in body fat and weight resulted from this moderate exercise program. Therefore, it can be concluded that programs of at least 30 minutes, three days per week are necessary for losing body weight and fat.

Moody et al. (47) viewed the effects of exercise on overweight college women. Eleven females participated in a walk-jog program six days per week for an eight-week period. No attempt was made to control diet. Energy expenditure was approximately 500 calories per day. Body weight and body fat as shown in Figure 1.10 decreased significantly.

Boileau et al. (5) formed two groups of sedentary college men based on their relative fatness as follows: obese, 25-46 percent fatness (N=8), lean, 10-20 percent fatness (N=15). All subjects walked or ran on a treadmill 60 minutes per day, five days per week for nine weeks. The approximate energy expenditure was 600 calories per exercise session. Significant reductions in body fat were found for both groups with greater reductions in the obese subjects. Gwinup (30) exercised 11 obese women daily for one year or longer with no dietary restrictions. Periods of walking each day were progressively increased. No weight loss occurred until walking exceeded 30 minutes daily. Weight loss paralleled length of time spent walking.

Some investigators have used progressive weight training as the means of decreasing body fat. In an experiment by Wilmore (85), 47 women and 26 men volunteered to participate in a 10-week period of intensive weight training, with an average attendance of 40 minutes per session, two days per week. Both men and women increased in lean body weight and decreased their absolute and relative body fat. Significant reductions in five of the seven skinfolds occurred for the women, but only in one for the men. Mayhew and Gross (43)

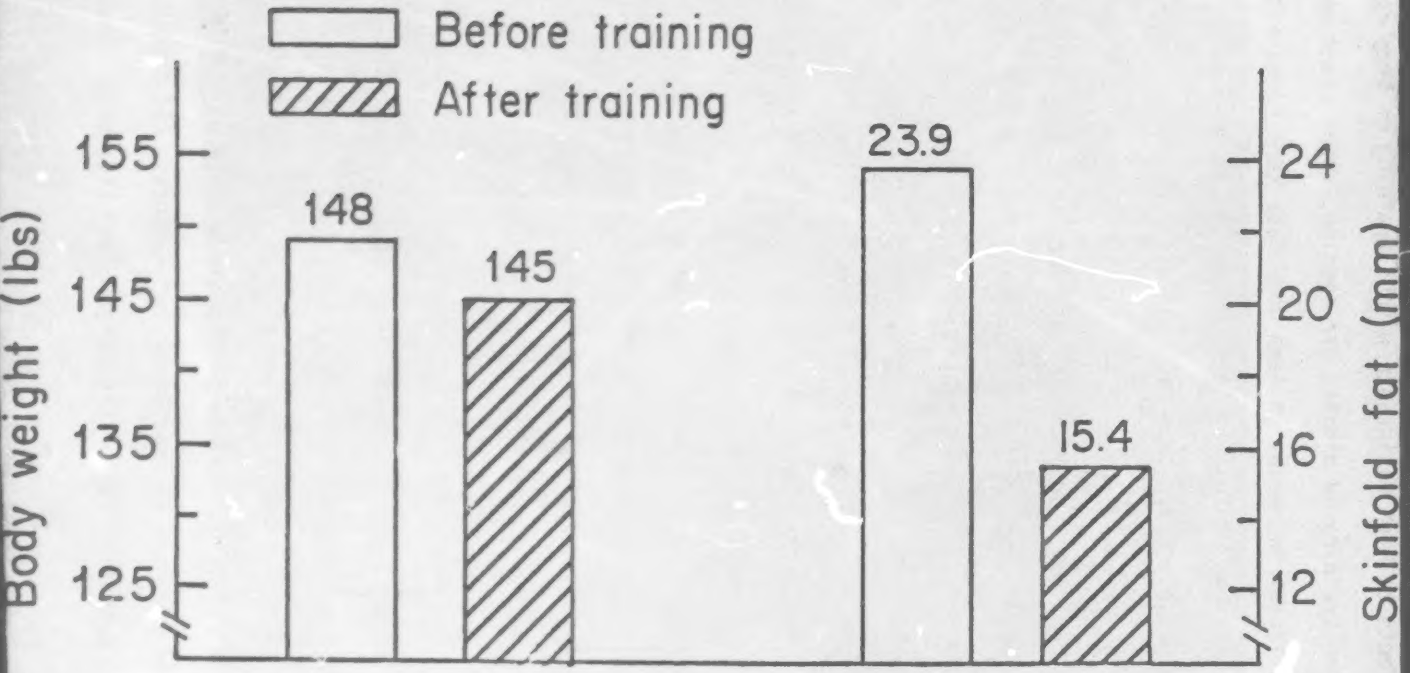


Figure 1.10 Effects of training on body weight and skinfold fat (47)

evaluated the effects of high resistance weight training on body composition of 17 college women training 40 minutes per session, three times weekly for nine weeks. Significant increases in lean body mass were found with relative body fat decreasing. Most weight training programs change percent body fat by increasing muscle weight rather than decreasing fat weight.

In summary, fat reduction results achieved from exercise programs depend on the frequency, duration, and intensity of exercise. Two days per week of exercise does not seem to be adequate in reducing fat. Reductions in fat have been found with three days per week programs, but exercising four or more days per week is desirable. The key to fat reduction seems to be in total energy cost, i.e., the number of calories burned during exercise. Activities of higher intensity such as jogging, cycling, or swimming burn more calories per minute and thus would be more desirable in fat reduction than low intensity activities. Duration is an important consideration. Research indicates that at least 30 minutes per exercise session is desirable for body weight and fat loss. Weight training is not as desirable for fat reduction as endurance activities because the fat weight changes only slightly.

Flexibility

Flexibility is defined as the range of possible motion in a joint or group of joints (20). For example, the flexibility of the elbow joint is movement from full flexion to full extension. The ability to touch one's toes primarily depends on the flexibility of the hip joint, spinal column, and rear leg muscles.

Joint range of movement is limited by two factors: (1) bony structures of the joint; and (2) extensibility of the surrounding ligaments, tendons, and muscles.

The bony structure of a joint basically cannot be altered but the extensibility of ligaments, tendons, and muscles can be greatly affected by stretching exercises. Stretching these tissues gradually lengthens them and the joint range of movement is therefore improved.

Flexibility is specific to a joint, that is, good flexibility in the hip and spine does not necessarily imply good flexibility in any other joint. However, general stretching exercises will enhance both simple and complex movements of the body, thereby improving the flexibility of many joints.

Benefits derived from flexibility exercise are described by Melograno and Klinzing (44) and include:

1. Injury Reduction - the chance of overstretching and injuring a muscle is lessened when the muscle possesses great extensibility.
2. Muscle Relaxation - tight, stiff muscles from inactivity are relaxed by stretching.
3. Skill Enhancement - sufficient flexibility is needed in certain joints before skills can be mastered (e.g., shoulder flexibility is necessary for proper serving techniques in tennis).
4. Graceful Movement - coordination of common movements is enhanced by having flexible joints. Individuals who lack flexibility move stiffly while walking, running, lifting, or reaching. This leads to inefficiency of movement.

There are two methods of stretching to promote flexibility in the body. The first, ballistic stretching, involves bouncy, jerky movements where a body part is put into motion and the momentum carries it through to the muscles' stretched limit. Ballistic stretching is often discouraged because it tends to cause soreness in the muscles the day following the stretch (20). There is come experimental evidence indicating that a "stretch reflex" occurs in the muscles from ballistic stretching. The "stretch reflex" causes the muscles to contract and resist the stretch thus resulting in small muscle spasms which eventually lead to soreness. The second method, static stretching, is recommended because a firm, steady stretch inhibits the "stretch flex" in the muscles with its delayed soreness, yet improves muscle extensibility. In addition, if muscle soreness already exists, static stretching may be used to relieve it. The basic components of yoga involve static stretching and therefore flexibility training.

There is an advantage in using some ballistic stretching for warm-up purposes so long as the movements are slow and not fast and jerky. This should help prevent injury and excessive muscle soreness. Some soreness should be expected in the early stages of any conditioning program, but with the proper precautions and adaptation the soreness will disappear.

The notion that weight training decreases flexibility is not true. Many investigators have shown that there are no harmful effects of weight training on flexibility if the movements are performed through the joints' full range of movement (20). Also, flexibility exercises should be integrated into the program. However, if the weight training involves a small range of motion and the exercises are performed incorrectly, flexibility can then actually be decreased.

Factors affecting flexibility have been summarized by deBries (20):

1. Activity - Active individuals tend to be more flexible than inactive individuals. Connective tissues shorten from disuse, thus, range of motion is decreased.

2. Age - Flexibility usually decreases with age partly because connective tissue shortens with age and partly because people become more sedentary.
3. Sex - Females are generally more flexible than males due to some joint structure differences (for example, in the hip) and greater muscle extensibility.
4. Temperature - Warming a muscle and joint will increase range of motion 10 to 20 percent.

Muscular Strength and Endurance

Strength is defined as the force a muscle group can exert against a resistance in one maximum effort (33). Muscular strength is proportional to the cross-sectional dimension of the muscle or muscle group being studied. The larger the muscle the greater the strength. There are basically two types of muscular contractions used when examining strength. One type is static or isometric contraction when the muscle may be contracting maximally but the limb does not move. The other type is dynamic or isotonic contraction. Here the length of the muscle changes during the contraction as the limb goes through a range of motion. Actually, there are two types of isotonic contractions: concentric and eccentric. Concentric contraction means the muscle shortens and usually positive work against gravity is done (example, biceps curl exercise). Eccentric contraction refers to the muscle lengthening and negative work is performed (example, letting the weight down from the biceps curl position).

Muscular endurance is defined as repeated contractions against the same resistance until local fatigue factors interfere with continuation. Performing situps or pushups until they can no longer be performed constitutes muscular endurance. Energy stores in the muscle cells plus the supply of blood to the muscles limit muscular endurance exercise. Strength of the muscles is also inherent in the ability to perform muscle endurance activities. Generally, the stronger the muscle the better the muscle endurance also.

While isometric exercise (pushing against immovable objects) may improve strength at the specific angles of training, it does little or nothing for circulation, muscular endurance, or flexibility. Isometric training for developing strength generally involves one maximal (or near-maximal) muscle contraction held four to six seconds. However, six to ten repetitions of this procedure will result in the best development of strength for isometric training. Isotonic exercise involves repeated contractions through a full range of movement in the joints and promotes circulation through the muscles. Therefore, strength, muscular endurance, and flexibility are promoted through isotonic training.

Strength training of high intensity using both isometric and isotonic methods generally increases muscle mass. The stimulus of the large weight resistance causes muscle mass to increase. This is called hypertrophy and is due to the increase in muscle fiber size primarily from the increase in proteins deposited in the cells. In addition to the increase in muscle size, isotonic training causes an increased number of capillaries to be used in the muscle. More blood supply is therefore available to the cells. Energy stores inside the cells are also increased through isotonic training thereby improving the function of the muscles. The actual speed of muscle contraction is increased with strength training regimens, i.e., faster movements are possible. The power of the muscles is therefore improved since power is defined as the work of the muscles done at a high rate of speed. Thus, muscular endurance is improved through isotonic training, when there is a better blood supply and more energy stores available for muscle cell use. There have been claims that traditional weight training programs do not improve the cardiorespiratory system and, therefore do not affect aerobic capacity. However, this question is now open for minimal rest between sets of exercises and the total workout time is performed in a continuous manner.

The converse to muscle hypertrophy is atrophy or wasting away. If muscles are not used regularly, their size and function diminish. A good example of this is the observable deterioration of muscles on a limb that has had a cast for several weeks. The muscle cells decrease in size (protein is lost), the energy stores inside the cells are reduced, and the blood supply to the muscle is lessened.

Weight training on an every other day basis will result in strength gains that average two to six percent each week (1, 41). The day between weight training workouts is beneficial for recuperating from the strenuous work. Apparently, muscle proteins are built up during the day of rest and waste products from the workout are removed. The person is then adequately prepared to work hard the following day in a regular workout session.

In order to improve muscular strength and endurance, the principle of overload must be followed. Overload means that the amount of weight or resistance must be gradually increased each week. When this extra work is gradually introduced, the muscles respond physiologically by adding more protein, energy stores and blood supply. Thus, their function is improved. The introduction of the overload stress must be gradual to allow the muscles to adapt and improve. If the overload stress is too great, the muscles fatigue rapidly and performance is reduced.

In addition to the overload principle, a high intensity effort must be developed by the muscles in order to cause maximum improvements in muscular strength and endurance. To improve strength, the weight resistance must be very high and just a few repetitions of movement performed. To improve muscular endurance, the weight resistance must be low and many repetitions of the exercise performed. In both cases, the efforts are near maximum but in the strength emphasis program the muscles are required to produce great force in four to six repetitions. In the muscular endurance program, the muscles are required to release large amounts of energy in the cells for repeated contractions of 15 to 20 repetitions. If time permits, three sets of exercises will give better results than one or two.

Mathews and Fox (42) have made some interesting observations concerning strength training. Individual differences in body type influence the growth in muscle girth. Persons of the mesomorphic type (muscular, and large bones, with wide shoulders, and narrow hips) respond the most to muscular training. Ectomorphs (lean, small bones, with narrow shoulders, and hips) respond less. Ectomorphic types of people increase strength, however, without the large increases in muscle size. An obese person is generally classified as an endomorph (narrow shoulders and wide hips). Mesomorphs can also be heavy and obese. Through a strength training program it is possible for an obese person to improve in muscle strength without large increases in girth. This is partially due to a concomitant loss in fat.

Plateaus in strength gains occur during training programs. That is, there is a rise in strength through training, then a level is reached where strength stays the same for a while. This usually indicates that the muscles have adapted to the resistance being lifted. After the adaptation and the introduction of a new overload resistance, another rise in strength occurs, and so on. Plateaus in training also may be due to fatigue and "going stale." The latter is a term used to describe psychological boredom of repetitive training and is best prevented by offering variety in the training. By just changing the workouts slightly or doing a few new exercises the boredom of the same day-after-day regimen is prevented.

After a certain level of strength is acquired, it may be maintained by fewer workouts. It is generally agreed that strength, once attained, subsides at slower rates than it develops (42). One or two workouts a week may be all that is needed to maintain strength levels. However, this area is open for further research.

Strength and Muscle Endurance Relationships

Clarke (11) has summarized relationships between strength and muscular endurance. These relationships are listed below:

1. The amount of weight resistance required to exhaust a muscle during repetitive contractions depends on the strength of the individual. In other words, stronger persons need to lift more weight when training for muscular endurance. Therefore, individuals with greatest muscular strength have greatest absolute muscular endurance also.

2. There appears to be a specific combination of load (weight resistance) and speed of movement which produces maximum work output. Slow contractions with high weight resistance result in great strength gains, whereas fast contractions with low weight resistance result in muscular endurance improvements. In order for the total work output to be the same in both conditions, the number of repetitions has to be much larger for the endurance situation.
3. Fatiguing a muscle reduces its ability to apply tension. Strength drops off rapidly with fatigue. There is a close relationship between strength and muscular endurance. The faster a person can recover from an exhaustive endurance exercise, the faster strength is recovered.

Types of Strength Training

There are generally five groups of strength or weight trainers. The first, weight lifters, comprise a small group of athletes interested in competing in two Olympic lifts - the snatch, and jerk. They train with maximal poundages and do not exceed three repetitions per exercise set.

Secondly, the power lifters are concerned with the development of brute strength. They compete in the bench press, squat, and dead lifts all of which involve large amounts of weight. Their training includes extremely heavy weights with low repetitions per set and many sets per exercise.

The third, body builders, are interested in physique. They develop great definition (how the muscles look) by performing several sets of an exercise with a high number of repetitions in each set. This engorges the muscles with blood increasing their size (the so-called "pumping effect").

The fourth group, athletes, use specific weight training programs to develop strength in the movement characteristics of their sport.

Finally, there are those of us who simply use weight training programs to keep in good muscle tone and wish to derive a few benefits from all of the previous four groups. Lifting weight increases blood pressure and could be dangerous to perform for many middle-aged men. A weight training regimen is recommended as an adjunct to an aerobics program and used for long-term maintenance of muscular strength and endurance.

Warm-up and Cool-down

Warm-up

There are two classifications of warm-up to define: (1) specific - this includes practicing or rehearsing a specific event (such as swinging a baseball bat before batting); and (2) general - this usually includes exercise that is unrelated to the competitive event.

The latter classification (general warm-up) is most important in physical fitness programs. General body warm-up is just that - increasing the internal (or core) body temperature through various exercises such as stretching, calisthenics, jogging, etc.

Increasing the internal temperature of the body is very important to the metabolism of the muscles and nerves. The chemical reactions within the cells speed up. For each degree of increase in body temperature, the metabolic rate increases 3 percent (2). This means that nerve messages will travel faster and muscle fibers will contract and relax faster. The muscles are therefore stronger after warm-up and recover quicker after exertion.

Increasing internal temperature through warm-up exercises also affects circulation. The blood vessels in the muscles dilate allowing more blood to flow to the cells, thus more nutrients can be delivered to the cells and more waste products removed. Hemoglobin, the oxygen carrying compound in the blood, gives up more oxygen to the muscle cells when the blood temperature is increased. Myoglobin, the oxygen storing compound inside the muscle cell, also releases more oxygen when the surrounding temperature is increased.

During a general body warm-up, blood flow through the lungs is increased. The exchange of oxygen and carbon dioxide is enhanced, thus increasing the oxygen supply and carbon dioxide release. As a result, the efficiency of the cardiorespiratory system is increased.

The above physiological phenomena result when the body is actively warmed-up. That is, the body is actively moved and many muscles are used. This active warm-up is more desirable than passive warm-up where muscles are heated by means of hot baths, showers, towels, and diathermy. Although the latter are somewhat beneficial, they should not be confused with active warm-up. An external heating source actually diverts blood flow from the muscle to the skin to combat the additional heat being introduced to the local area. The decreased circulation to the muscle can result in weakness and fatigue. Active warm-up promotes circulation inside the muscle.

The optimal active warm-up time has been recommended by deBries (20) to be ten to 15 minutes. This should result in a rise of one to two degrees F in the muscles' internal temperature. The time factor can vary due to several factors, including the individual's level of fitness, the activity, the temperature and humidity of the environment, the clothes worn, and the intensity of warm-up. A rule of thumb to follow for intensity and duration of warm-up under normal environmental conditions is to exercise until perspiration is evident. Wearing warm clothing will speed up the warm-up and retain the heat for several minutes. Warm clothing (rubber suits, etc.) should be avoided in warm, humid environments.

Muscle injury and soreness often are the result of an improper warm-up. Strenuous exertion without previous warm-up, can cause muscle strains and in some cases a muscle tear. The muscles usually injured are the antagonists (opposite) of the strong contracting muscles. These "cold" antagonistic muscles relax slowly and incompletely when the agonists (prime movers) contract and thus retard free movement (48).

Several studies have demonstrated that improvements in physical performance (such as running, jumping, and throwing) are significant following warm-up. These studies support the physiological principles explained previously and are summarized in an article by Neuberger (51).

Cool-down

Just as the warm-up serves to gradually increase the internal body temperature, the cool-down after a workout serves to gradually lower body temperature. An active cool-down (such as walking) prevents blood from pooling in the legs (14) and circulation back to the heart is promoted. This amplified circulation will rid muscles of the fluid build-up and metabolic wastes that result from the muscular contractions in the workout. The fluid build-up and metabolic wastes are primarily responsible for the muscle soreness that occurs after a very strenuous exertion. It is recommended that an active cool-down of walking and stretching be continued for five to ten minutes after a strenuous workout.

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CHAPTER 2

RESEARCH METHODOLOGY

Selection Program for Participants

Information describing the opportunity to participate in a physical fitness program was distributed to all officers in the Richardson Police Department, Texas Department of Public Safety, and Dallas Police Department. Interested officers were asked to complete an application form for the program. The applications were screened and only those officers who were apparently healthy and sedentary were selected. The volunteers then attended a briefing during which the testing and exercise programs were described in detail and informed consent obtained. The following criteria for selection of participants in the study were utilized.

1. Health: Participants must be free from coronary heart disease or other serious health problems.
2. Age: 21-35 years for young officers
   Age: 36-52 years for middle-aged officers
3. Availability: Participants must be available for training for 20 consecutive weeks plus 2 weeks for evaluations prior to and following the training phase.
4. Vacations: Participants will take no vacations during the project that would necessitate missing more than four consecutive days.
5. Life Style: Participants will not change general living habits during the project, such as diet and smoking habits.
6. Sedentary: Participants should not have been involved in any type of regular physical activity for at least one year.

7. Other physical activities during project: Officers will not participate in physical activities other than the training project.
8. Volunteers: Officers will be asked to participate on a volunteer basis.
9. Random Sampling: Officers must be willing to participate in any of the exercise or control groups to be chosen.

The officers were required to complete various medical and physical fitness evaluations and attitude questionnaires before being allowed to participate in the evaluation phase of the program. All officers completed a medical history questionnaire which was reviewed by a physician.

The Guidelines for Graded Exercise Testing published by the American College of Sports Medicine (1) were followed. Officers who exhibited abnormal ECG or blood pressure results on this "screening" test as determined by the physician were asked to consult their private physician and were not selected for the study.

Physical Fitness Evaluation

Prior to the first visit to the laboratory for testing, each participating officer was required to abstain from eating, drinking, and smoking for fourteen hours. Upon arriving at the laboratory a 15 ml blood sample was drawn for analysis of serum lipids (cholesterol and triglycerides), glucose, and uric acid. A second sample was drawn on a separate day for comparison and if the two samples did not agree, a third analysis was required.

Resting cardiovascular (CV) function was assessed by seating each officer in a quiet room for a 10-minute period and then recording his resting heart rate and blood pressure. Heart rate was counted for one minute using a stethoscope and blood pressure was measured using a mercury sphygmomanometer. Submaximal CV function was measured by heart recovery from a three-minute step test (11). Each officer performed the three minute test by stepping up and down on a 12-inch bench at a rate of 24 trips per minute. Immediately after completing the three minutes of stepping, the officer was seated and his recovery heart rate was counted for one full minute (0:05 to 1:05 into recovery).

In addition to the initial screening test, maximum cardiovascular-respiratory function was assessed a second time by a treadmill test during which the individual was asked to perform "all out." The young officers, ages 21 to 35 years, were tested using a treadmill running protocol described by Astrand (2) as modified by Pollock et al. (16). The speed of running for each individual remained the same throughout the test; the grade of the treadmill was zero percent during the first three minutes and then increased 2.5 percent grade every two minutes thereafter. The middle-aged officers were tested a second time using the same Bruce treadmill test protocol (5) described previously. The maximum amount of time performed on the treadmill test is considered a measure of working capacity, i.e., the longer one performs in the standard protocol, the more fit the individual. During the second treadmill tests maximum oxygen intake (VO_2 max), maximum heart rate (MHR), and maximal pulmonary ventilation (V_E max) measures were monitored. Metabolic procedures and calculations described by Consolazio et al. (7) were followed.

Body composition was analyzed by various measurements of body weight, girths, and skinfold fat. Body weight was measured to the nearest 10 grams on an Acme scale and later converted to pounds for statistical analysis. Skinfold fat measures were determined to the nearest 0.5 mm with a Lange caliper and included the chest, axilla, triceps, abdomen, hip, and thigh locations. Recommendations published by the Committee on Nutritional Anthropometry of the Food and Nutrition Board of the National Research Council were followed in obtaining skinfold data (12). Girth measures were taken to the nearest 0.1 cm with a Lufkin steel tape at the shoulder, chest, abdomen, waist, gluteal, thigh, arm (biceps), and forearm locations. Specific recommendations on the exact locations for obtaining skinfold and girth measures are shown by Behnke and Wilmore (3). Body density was calculated for the young officers using the skinfold formula reported by Pascale _et al_. (15). The formula involving both skinfold and girth measures reported by Pollock _et al_. (18) was used to calculate body density for the middle-aged officers. Body density was converted to percent body fat using the formula reported by Siri (19).

In addition to the above anthropometric determinations, body density was measured by the underwater weighing technique (9) and percent body fat calculated by the Brozek _et al_. formula (4) for young officers of the DPD. This technique is the most accurate method of determining body composition and was used mainly to document more accurately the body fat levels of young officers and the body density changes through weight training.

Vital capacity (VC) of the lungs and forced expiratory volume of air expelled in one second (FEV_1) were measured using a rolling seal spirometer (Ohio Medical Model 842). The procedures outlined by Kory _et al_. (13) and W. E. Collins, Inc. (6) were followed.

Various motor ability field tests were administered to represent areas of physical fitness that may enhance the performance of a police officer when challenged physically. Flexibility of the lower back and legs was determined by the sit and reach test (14). The total number of pushups and the number of bent-knee situps performed in one minute were used as measures of muscular endurance (14). Power was measured by the vertical jump test (10) and agility was represented by the Illinois Agility Run (8).

Strength was measured by both isotonic and isokinetic techniques. The Universal Gym Apparatus was used to measure the one-repetition maximum bench press strength of all participating officers. For those officers later assigned to the weight training phase of the study, additional isokinetic strength measures were obtained using Cybex machinery. The isokinetic devices measured the dynamic tension produced in the muscles at every point in their shortening range and was recorded as torque in ft.lbs. Basic muscular strength was assessed during a slow contractile speed (30^{0} per sec.) and functional muscular strength was measured during a fast contractile velocity (180^{0} per sec.). Peak torque achieved was recorded for both the slow and fast techniques in the knee extension, leg press, and bench press modes of exercise.

In addition to some of the above field tests, participating officers in the Richardson Police Department were asked to perform the field test devised by that department. The field test had been used by the RPD for the past two years as a screening physical fitness test for applicants to the department. It consists of four parts, each of which is timed separately and then added to obtain a total score for the entire test. The first phase of the test is an obstacle course which included a three- and a six-foot wall to climb, utility poles to zig-zag around, a tunnel to crawl through, a six-inch beam to walk, and a 12-foot high horizontal ladder to cross using the hand-over-hand technique. The second phase is called the body drag and involves running 65 feet, picking up a 160-pound dummy and dragging it 65 feet back to the start. The third phase is a stair run which includes two trips up and down two flights of stairs. The final phase is termed a "street chase" and consists of running 440 yards around a grass field area. The RPD feels that these items relate to the job requirements of their patrolmen.

Questionnaire Development

Nine separate psychological and attitudinal instruments were administered to the participating experimental and control group officers at three points in time during the 20-week programs. These instruments are briefly described below:

1. Medical History Questionnaire (MHQ) - This standard form developed by The Institute for Aerobics Research, is used to evaluate various personal and family health-related issues. Although it is primarily concerned with specific medical conditions, it also includes information on sports and other physical fitness activities and preferences.
2. Background Information Report Form (BIRF) - This questionnaire provided additional information in the areas of personal and job-related identification, medical problems, experience with formal physical fitness activities, and family patterns of exercising.
3. Self-Evaluation Questionnaire (SEQ) - One of two standard psychological instruments used, this test examines anxiety levels, yielding two scores, i.e., state anxiety ("How I feel right now") and trait

anxiety ("How I generally feel"). Each score is generated by the indicated degree to which each of twenty statements is applicable to the individual.

4. Attitude Questionnaire (AQ) - This second standardized psychological instrument consists of 100 statements of attitudes and interests to which the individual responds with "true" or "false," depending upon the perceived applicability of each statement. An "estimation" score reveals perception of self relative to an appropriate peer group, while an "attitude" score indicates degree of favorable reaction to physical fitness activities.
5. Physical Fitness and Job Relatedness Questionnaire Part I (PFJRQ-I) - Perceptions of physical abilities in the performance of specific police tasks and attitude toward physical fitness programs are the subject of this questionnaire.
6. Physical Fitness and Job Relatedness Questionnaire Part II (PFJRQ-II) - This lengthy questionnaire was borrowed in part from work by Kroes, examining various sources and degrees of stress and tension relative to specific police functions.
7. Health Opinion Questionnaire (HOQ) - Attitudes toward health, particularly in relation to heart attacks, have been examined with this instrument in previous studies by Heinzlemann.
8. Project Participation Questionnaire (PPQ) - Two different participation instrument forms were used. The pre-test form examined reasons for

volunteering for the experimental program, as well as expectations of the participants; the post-test form examined self-reported results.

9. Spouse Questionnaire (SQ) - Evaluations of program results from the viewpoint of the participant's husband or wife are provided by this instrument. Since the sample of women officers was very small, the spouse questionnaire will reflect the opinion of the male officers' wives.

Questionnaire Administration

With the exception of the medical history questionnaire and the spouse questionnaire, all instruments were administered in a package to participating officers at three times during the 20-week programs. Pre-test questionnaires were completed during initial orientation and medical/stress testing. Mid-test forms were administered following the tenth week of training. Post-test data on participants were collected when the officers reported for their final medical/stress testing; the spouse questionnaires were mailed individually to the officers' homes.

National Survey Methodology

One of the major aspects of the current physical fitness project consisted of the determination of the extent to which various types of physical and medical fitness or conditioning programs are available to police officers at the present time. This task was accomplished by means of a survey administered to a nationally representative sample of police agencies.

Sample Selection

The operational definition of a "nationally representative sample" of police agencies necessitated the identification of a stratified, random probability sample of agencies to receive the survey instrument. Five groups or strata of police agencies were identified as follows:

Stratum I - police agencies in cities with populations of 100,000 or more

Stratum II - police agencies in cities with populations between 25,000 and 99,999

Stratum III - police agencies in cities with populations between 2,500 and 24,999

Stratum IV - state police agencies

Stratum V - county police and sheriff agencies

It was decided that approximately 100 completed survey questionnaires per stratum would provide an adequate basis for analysis. Based on previous experience, a response rate of about 70 percent was considered attainable. Therefore, it was necessary to select approximately 150 jurisdictions in each stratum to receive surveys (70 percent of 150 yields approximately 100 surveys). Subsampling, then, was necessary in three of the five strata; all agencies in Strata I and IV received surveys.

To maintain the randomness of subsample selection, all potential respondents in each of Strata II, III, and V were listed in alphabetical order within states and states were then arranged geographically from east to west according to meridian. The sampling rates utilized varied, of course, in the three strata. Stratum II agencies were selected at a rate of 1 in 5, Stratum III agencies were chosen at a rate of 1 in 29, and Stratum V agencies were selected at a rate of 1 in 21.

The final sample selected to receive the surveys, then, consisted of the following number of agencies:

Stratum I - 153 large city agencies
Stratum II - 146 medium-sized city agencies
Stratum III - 162 small city agencies
Stratum IV - 49 state agencies
Stratum V - 145 county police and sheriff agencies

Questionnaire Development and Pre-testing

A draft of the survey instrument was pre-tested in six police agencies in the states of Maryland and Virginia. None of these departments were included in the final sample. As a result of the pre-testing, a number of revisions in the questionnaires were made to insure greater clarity.

The final questionnaire consisted in part of eleven screening questions with a total of 108 followup items. These questions addressed current physical fitness training programs, discontinued physical fitness training programs, sports activities, special group rates, funding, weight maintenance programs, periodic medical examinations, periodic physical performance tests, entrance-level medical examinations, entrance-level physical performance tests, and recruit training. Forty-two additional questions concerned number of employees, selection requirements, performance evaluation, retirement, and administrative and legal issues.

Survey Administration

Final printed forms of the survey instrument were mailed to the 655 randomly selected police agencies. Completed questionnaires were returned to the IACP, where each survey was reviewed for completeness and accuracy prior to computer data analysis. Responding agencies were assured individual confidentiality regarding specific data reported.

Police Officer Survey

In conjunction with the survey of the physical fitness programs provided by police departments, a description of the individual police officer's attitudes toward this type of program and of their assessment of their own state of physical fitness was sought. In order to obtain this information, a question[illegible] mailed to a stratified, random probability sample of 3,814 sworn police officers from the departments responding to the national survey.

CHAPTER 3

RESULTS OF PHYSICAL FITNESS EVALUATION OF PROGRAM VOLUNTEERS

The main purpose of this section is to report the results of the information collected on 213 members of the Dallas and Richardson Police Departments and the Texas Department of Public Safety. The information will discuss coronary heart disease risk and physical fitness levels of police officers.

Coronary Heart Disease Risk Factors and Physical Fitness Levels

Coronary heart disease is prevalent in most industrialized countries, and in the U.S. alone the annual death toll from coronary heart disease reaches approximately 600,000 (1). Risk factors established by the American Heart Association include the following: high blood pressure, elevated blood fats (mainly cholesterol and triglycerides), cigarette smoking, obesity, physical inactivity, elevated blood sugar and uric acid, family history, and excessive emotional stress (1, 6, 7). Population investigations, such as the Framingham study, have shown not only that the manifestation of coronary heart disease is influenced by certain risk factors but also that the probability is increased drastically with added numbers of risk factors (6, 9).

What is the physical fitness level and risk factor profile of police officers? How do they compare with other occupational groups? What are the physical fitness needs of police officers? A review of the literature failed to provide sufficient information to give adequate answers to these questions. There is some evidence in the literature suggesting that policemen are average to below average in physical fitness and risk for coronary heart disease when compared to the general sedentary population (4, 5, 11, 14, 15, 18).

Kaminski (8) reported the need for physical fitness programs for police officers. He stated that physical fitness for law enforcement purposes consists of two distinct but equally important areas; 1) the cardiorespiratory system (conditioning of the heart, lungs and circulatory system); and, 2) motor ability (achievement abilities such as muscular strength and endurance, agility, and flexibility), that relate to the skills necessary to perform the basic job-related tasks. Good cardiorespiratory fitness is indicative of the ability of the body to adapt and recover from periods of physical stress. This type of fitness results in a more efficient performance of duty, reduced probability of heart disease, and less frequent on or off duty injury due to overexertion (3, 4, 14). A recent survey conducted with firemen who were placed on an exercise regimen showed lower worker's compensation loss (13). A good fitness program should lead to a greater career expectancy rate as officers would not have to retire prematurely for medical reasons.

Thus there is a need to quantify better the physical fitness level and risk factor profile of police officers. It is felt that this information will provide evidence as to their need for physical fitness and other preventive medicine programs.

The sample consisted of 213 male volunteer police officers from Dallas and Richardson (Texas) Police Departments, and the Texas Department of Public Safety. The officers were between 21 and 52 years of age and free from known cardiovascular or other serious diseases or disabilities. Several women were a part of the overall study but their sample was too small for inclusion in this report.

The data compiled from the physical fitness evaluation tests were averaged and standard deviations calculated. Then percentile score tables were constructed on each variable. To determine coronary risk, the data were compared to the standards recommended by the American Heart Association (1) and the Cooper Clinic. To compare the fitness levels of police officers, the data for the general population, the Los Angeles County Sheriff's Department Personnel, Highway Patrolment, and prison inmates were plotted on the norm scales developed for police officers.

Coronary Heart Disease Risk

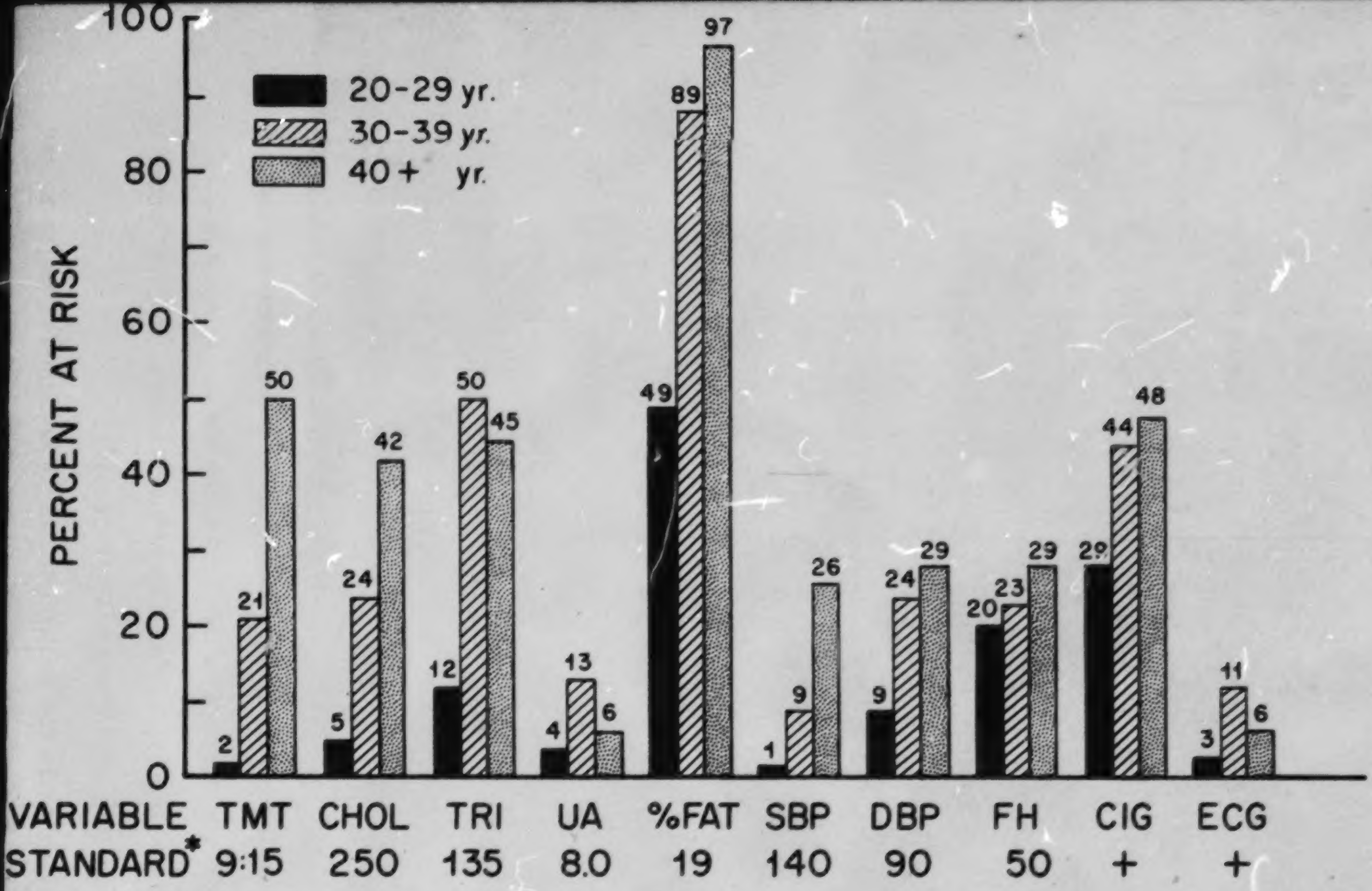
The results show a distinct increase in coronary risk with age. Compared to the general population, the police officers studied in this investigation were shown to be average in coronary risk in all variables except body fat in men 20-29 years of age; serum triglycerides and body fat in men 30-39 years of age; and treadmill performance, serum cholesterol, serum triglycerides, and body fat in the group aged 40-52. In comparison with 68 Los Angeles City Fire Fighters who were 40-50 years of age, the police scored higher in serum cholesterol, diastolic blood pressure, percent fat, and percent of smokers (13). Overall the younger police officers seem to be of average risk and the older officers appear to be at higher than average risk.

The results showed that of the 213 police officers studied, 90 percent had at least one risk factor, 50 percent had three, 33 percent had four, and 18 percent had five. An increase in coronary risk is significantly greater with each added risk factor (6, 9, 10). Thus, these data reflect the potential danger of coronary heart disease in these police officers. Figure 3.1 lists the criteria used to determine if an individual is at risk, and shows the percentage of police officers at risk for each age group.

Although much of the risk factor data found with police officers were considered average in relation to the general population in the United States, it must be remembered that Americans lead the world in deaths from coronary heart disease (1). The need for a good preventive medicine program for police officers is apparent.

Physical Fitness

Percentile tables were constructed for police officers and included data relating to working capacity, cardiorespiratory fitness, body composition, and motor ability. Tables 3.1 and 3.2 show data for police officers 21-35 years of age and Tables 3.3 and 3.4, 36-52 years of age. The 50th percentile on each table represents the mid point in the variable measured for each group of police officers with half scoring lower and half higher. For comparative purposes, data for the general population (2, 12, 16), inmates (17), Sheriff's Department Personnel (14) and Highway Patrolmen (18) are plotted on various tables.



CORONARY RISK FOR POLICE OFFICERS
20-52 YEARS OF AGE (n=213)

*Risk Factor Standards Used at Cooper Clinic, Dallas, Texas

Figure 3.1

Young Police Officers

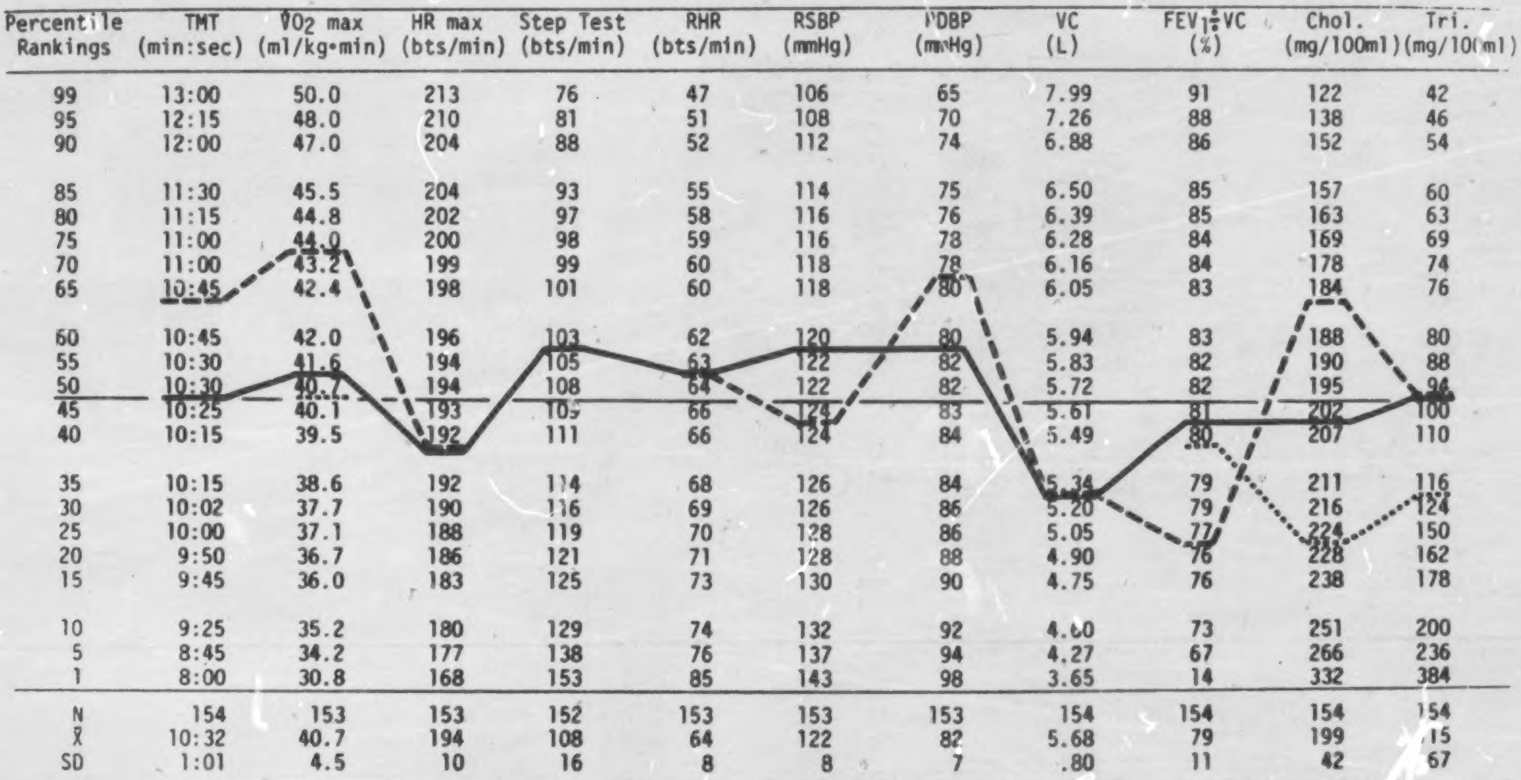
Tables 3.1 and 3.2 show normative data on working capacity, cardiorespiratory endurance, pulmonary function, serum lipids, body composition, and motor ability of police officers 21-35 years of age. When compared to the normal sedentary population of similar age, the younger officers were about the same in all variables except body weight, body fat, waist circumference, vital capacity, and trunk flexion, which were slightly higher. Since the average person in the U.S. is considered below standards in physical fitness compared to many other industrialized countries, the standards should be thought of as inadequate for young police officers.

Data from the Sheriff's Department Personnel and Highway Patrolmen show similar results to the young policemen in cardiorespiratory fitness, but show them to have higher levels of serum cholesterol and triglycerides. The young police officers in this study were also fatter. Firemen (not shown in tables) have greater cardiorespiratory endurance and less body weight, fat, and waist circumference (13).

The question that should be considered is how fit should young police officers be? Is a standard that is average for a normal sedentary population acceptable? If a job requires physical effort, such as running, climbing, and jumping; if an officer needs to have endurance and the ability to handle his own body weight, then the answer is negative. Many assignments on the police force do require intense physical activity. Therefore, higher levels of fitness are necessary.

A recent study conducted on 100 inmates showed them to be in better physical condition than police officers (17). This included a higher

Table 3.1 Work capacity, cardiorespiratory and pulmonary function, and serum lipids of police officers 21-35 years of age.

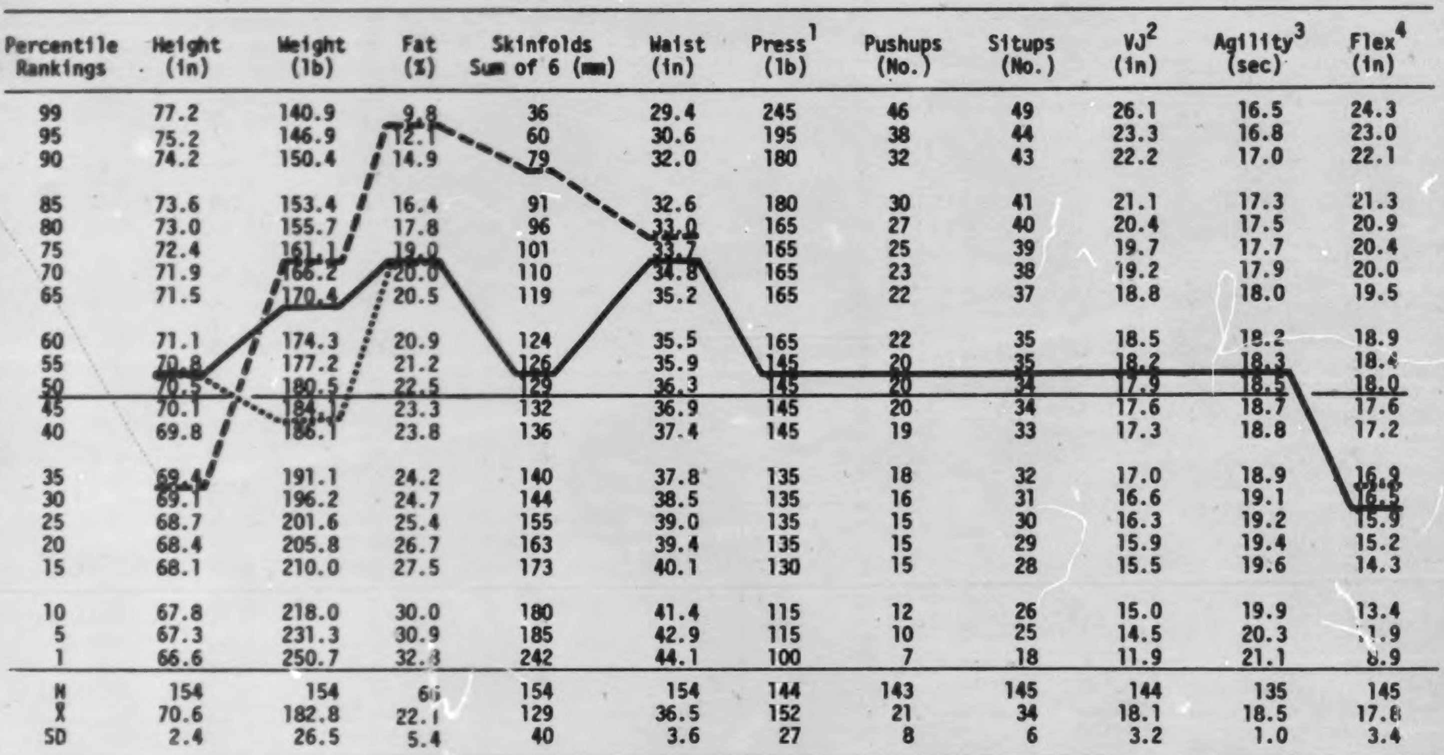


Percentile Rankings	TMT (min:sec)	$\dot{V}O_2$ max (ml/kg•min)	HR max (bts/min)	Step Test (bts/min)	RHR (bts/min)	RSBP (mmHg)	RDBP (mmHg)	VC (L)	$FEV_1 \div VC$ (%)	Chol. (mg/100ml)	Tri. (mg/100ml)
99	13:00	50.0	213	76	47	106	65	7.99	91	122	42
95	12:15	48.0	210	81	51	108	70	7.26	88	138	46
90	12:00	47.0	204	88	52	112	74	6.88	86	152	54
85	11:30	45.5	204	93	55	114	75	6.50	85	157	60
80	11:15	44.8	202	97	58	116	76	6.39	85	163	63
75	11:00	44.0	200	98	59	116	78	6.28	84	169	69
70	11:00	43.2	199	99	60	118	78	6.16	84	178	74
65	10:45	42.4	198	101	60	118	80	6.05	83	184	76
60	10:45	42.0	196	103	62	120	80	5.94	83	188	80
55	10:30	41.6	194	105	63	122	82	5.83	82	190	88
50	10:30	40.7	194	108	64	122	82	5.72	82	195	94
45	10:25	40.1	193	109	66	124	83	5.61	81	202	100
40	10:15	39.5	192	111	66	124	84	5.49	80	207	110
35	10:15	38.6	192	114	68	126	84	5.34	79	211	116
30	10:02	37.7	190	116	69	126	86	5.20	79	216	124
25	10:00	37.1	188	119	70	128	86	5.05	77	224	150
20	9:50	36.7	186	121	71	128	88	4.90	76	228	162
15	9:45	36.0	183	125	73	130	90	4.75	76	238	178
10	9:25	35.2	180	129	74	132	92	4.60	73	251	200
5	8:45	34.2	177	138	76	137	94	4.27	67	266	236
1	8:00	30.8	168	153	85	143	98	3.65	14	332	384
N	154	153	153	152	153	153	153	154	154	154	154
$\bar{X}$	10:32	40.7	194	108	64	122	82	5.68	79	199	115
SD	1:01	4.5	10	16	8	8	7	.80	11	42	67

TMT = treadmill time; VO_2 max = maximum oxygen intake; HR max = maximum heart rate; Step Test = 3 min step test recovery heart rate; RHR = resting heart rate; RSBP = resting systolic blood pressure; RDBP = resting diastolic blood pressure; VC = vital capacity; $FEV_1 \div VC$ = forced expiratory volume for one second divided by vital capacity; Chol. = cholesterol; Tri. = triglycerides.

•▬▬Inmates
▬▬Sedentary average
••••••Sheriff's Department and Highway Patrolmen

Table 3.2 Body composition and motor ability of police officers 21-35 years of age.



Percentile Rankings	Height (in)	Weight (lb)	Fat (%)	Skinfolds Sum of 6 (mm)	Waist (in)	Press[1] (lb)	Pushups (No.)	Situps (No.)	VJ[2] (in)	Agility[3] (sec)	Flex[4] (in)
99	77.2	140.9	9.8	36	29.4	245	46	49	26.1	16.5	24.3
95	75.2	146.9	12.1	60	30.6	195	38	44	23.3	16.8	23.0
90	74.2	150.4	14.9	79	32.0	180	32	43	22.2	17.0	22.1
85	73.6	153.4	16.4	91	32.6	180	30	41	21.1	17.3	21.3
80	73.0	155.7	17.8	96	33.0	165	27	40	20.4	17.5	20.9
75	72.4	161.1	19.0	101	33.7	165	25	39	19.7	17.7	20.4
70	71.9	166.2	20.0	110	34.8	165	23	38	19.2	17.9	20.0
65	71.5	170.4	20.5	119	35.2	165	22	37	18.8	18.0	19.5
60	71.1	174.3	20.9	124	35.5	165	22	35	18.5	18.2	18.9
55	70.8	177.2	21.2	126	35.9	145	20	35	18.2	18.3	18.4
50	70.5	180.5	22.5	129	36.3	145	20	34	17.9	18.5	18.0
45	70.1	184.1	23.3	132	36.9	145	20	34	17.6	18.7	17.6
40	69.8	186.1	23.8	136	37.4	145	19	33	17.3	18.8	17.2
35	69.4	191.1	24.2	140	37.8	135	18	32	17.0	18.9	16.9
30	69.1	196.2	24.7	144	38.5	135	16	31	16.6	19.1	16.5
25	68.7	201.6	25.4	155	39.0	135	15	30	16.3	19.2	15.9
20	68.4	205.8	26.7	163	39.4	135	15	29	15.9	19.4	15.2
15	68.1	210.0	27.5	173	40.1	130	15	28	15.5	19.6	14.3
10	67.8	218.0	30.0	180	41.4	115	12	26	15.0	19.9	13.4
5	67.3	231.3	30.9	185	42.9	115	10	25	14.5	20.3	11.9
1	66.6	250.7	32.8	242	44.1	100	7	18	11.9	21.1	8.9
N	154	154	66	154	154	144	143	145	144	135	145
X̄	70.6	182.8	22.1	129	36.5	152	21	34	18.1	18.5	17.8
SD	2.4	26.5	5.4	40	3.6	27	8	6	3.2	1.0	3.4

[1] Press = maximum one repetition bench press; [2] VJ = vertical jump; [3] Agility = Illinois agility run; [4] Flex = flexibility sit and reach.

- - — Inmates
—— Sedentary average
······ Sheriff's Department and Highway Patrolmen

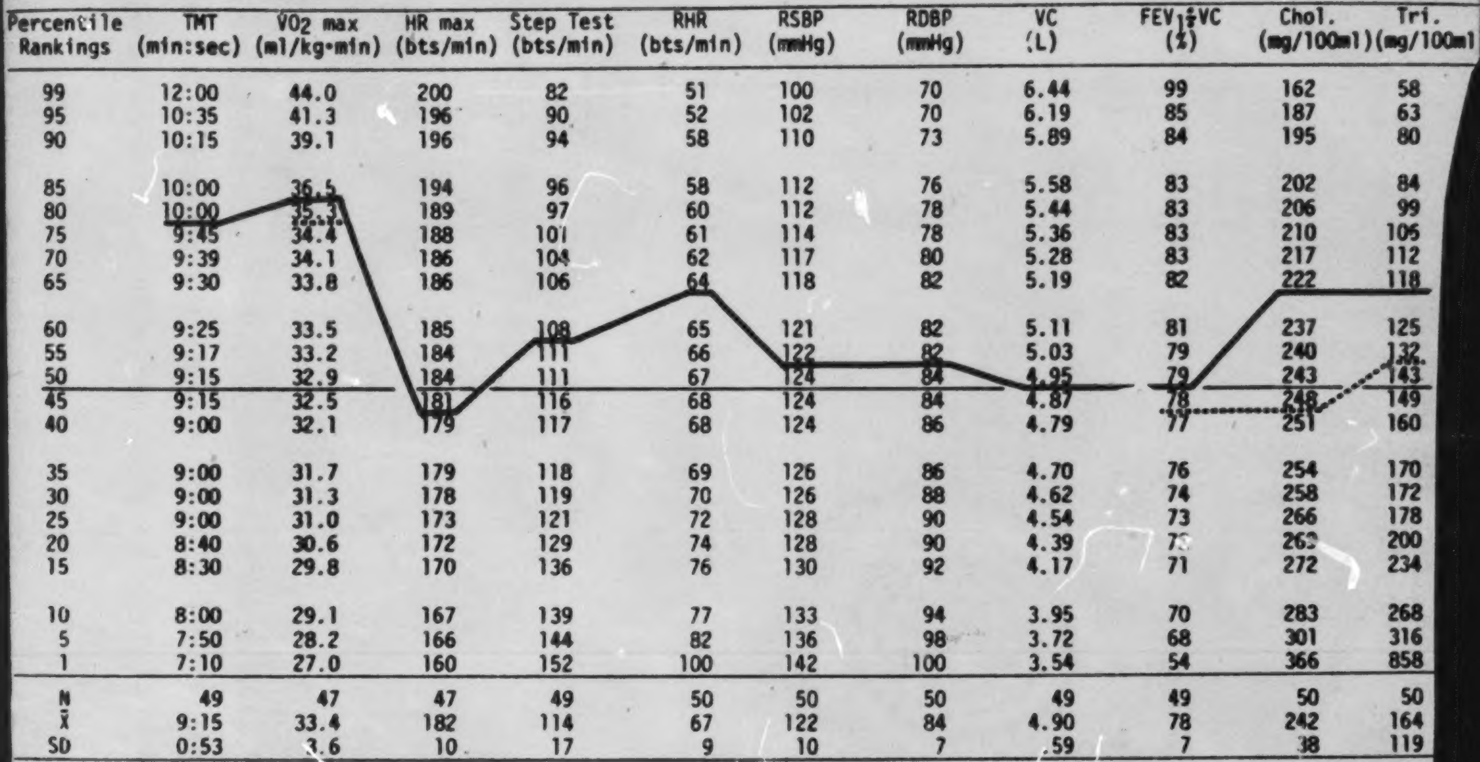
working capacity and cardiorespiratory endurance, and lower body weight, fat, waist circumference, diastolic blood pressure and serum cholesterol. This comparison to police officers has been shown elsewhere (5). The inmates' ability to expel air from their lungs quickly was lower and was thought to be related to their heavy smoking habit. Although most inmates lose body weight while incarcerated, it was surprising to find them in such good cardiorespiratory fitness. Similar to the police officers tested, the inmates had had no endurance training prior to being tested. It is imperative that police officers be in better physical condition in order to cope with fit young persons who commit crimes in a variety of situations.

Middle-Aged Police Officers

Tables 3.3 and 3.4 show normative data on physiological and performance variables of middle-aged police officers 36-52 years of age. When compared to the normal sedentary population of similar age, they were considered below average in working capacity, cardiorespiratory fitness and body composition. Specifically, the results show middle-aged police officers low in treadmill performance, maximum oxygen intake, efficiency on a bench step test; and, high in body weight and fat, waist circumference, and serum lipids. When compared to the normal population the middle-aged police officer is in worse physical condition than the young police officer.

The data from the Sheriff's Department Personnel and Highway Patrolmen show similar body composition results to the police officers in this investigation, but were closer to the normal population in cardiorespiratory

Table 3.3 Work capacity, cardiorespiratory and pulmonary function, and serum lipids of police officers 36-52 years of age.



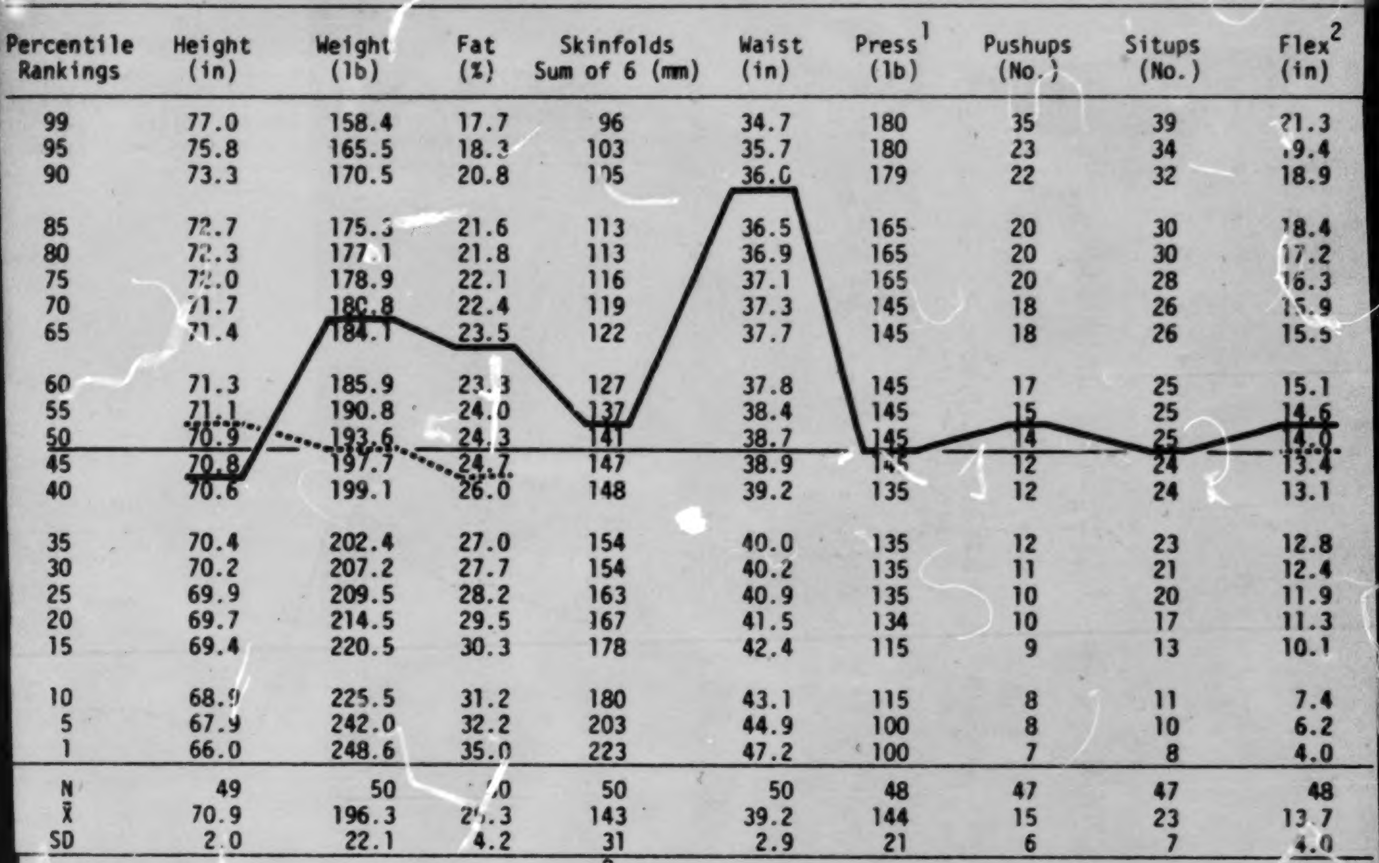
Percentile Rankings	TMT (min:sec)	$\dot{V}O_2$ max (ml/kg·min)	HR max (bts/min)	Step Test (bts/min)	RHR (bts/min)	RSBP (mmHg)	RDBP (mmHg)	VC (L)	FEV$_1$÷VC (%)	Chol. (mg/100ml)	Tri. (mg/100ml)
99	12:00	44.0	200	82	51	100	70	6.44	99	162	58
95	10:35	41.3	196	90	52	102	70	6.19	85	187	63
90	10:15	39.1	196	94	58	110	73	5.89	84	195	80
85	10:00	36.5	194	96	58	112	76	5.58	83	202	84
80	10:00	35.3	189	97	60	112	78	5.44	83	206	99
75	9:45	34.4	188	101	61	114	78	5.36	83	210	105
70	9:39	34.1	186	104	62	117	80	5.28	83	217	112
65	9:30	33.8	186	106	64	118	82	5.19	82	222	118
60	9:25	33.5	185	108	65	121	82	5.11	81	237	125
55	9:17	33.2	184	111	66	122	82	5.03	79	240	132
50	9:15	32.9	184	111	67	124	84	4.95	79	243	143
45	9:15	32.5	181	116	68	124	84	4.87	78	248	149
40	9:00	32.1	179	117	68	124	86	4.79	77	251	160
35	9:00	31.7	179	118	69	126	86	4.70	76	254	170
30	9:00	31.3	178	119	70	126	88	4.62	74	258	172
25	9:00	31.0	173	121	72	128	90	4.54	73	266	178
20	8:40	30.6	172	129	74	128	90	4.39	72	269	200
15	8:30	29.8	170	136	76	130	92	4.17	71	272	234
10	8:00	29.1	167	139	77	133	94	3.95	70	283	268
5	7:50	28.2	166	144	82	136	98	3.72	68	301	316
1	7:10	27.0	160	152	100	142	100	3.54	54	366	858
N	49	47	47	49	50	50	50	49	49	50	50
$\bar{X}$	9:15	33.4	182	114	67	122	84	4.90	78	242	164
SD	0:53	3.6	10	17	9	10	7	.59	7	38	119

TMT = treadmill time; $\dot{V}O_2$ max = maximum oxygen intake; HR max = maximum heart rate; Step Test = 3 min step test recovery heart rate; RHR = resting heart rate; RSBP = resting systolic blood pressure; RDBP = resting diastolic blood pressure; VC = vital capacity; FEV$_1$÷VC = forced expiratory volume for one second divided by vital capacity; Chol. = cholesterol; Tri. = triglycerides.

——Sedentary average

······Sheriff's Department and Highway Patrolmen

Table 3.4 Body composition and motor ability of police officers 36-52 years of age.



Percentile Rankings	Height (in)	Weight (lb)	Fat (%)	Skinfolds Sum of 6 (mm)	Waist (in)	Press[1] (lb)	Pushups (No.)	Situps (No.)	Flex[2] (in)
99	77.0	158.4	17.7	96	34.7	180	35	39	21.3
95	75.8	165.5	18.3	103	35.7	180	23	34	19.4
90	73.3	170.5	20.8	105	36.0	179	22	32	18.9
85	72.7	175.3	21.6	113	36.5	165	20	30	18.4
80	72.3	177.1	21.8	113	36.9	165	20	30	17.2
75	72.0	178.9	22.1	116	37.1	165	20	28	16.3
70	71.7	180.8	22.4	119	37.3	145	18	26	15.9
65	71.4	184.1	23.5	122	37.7	145	18	26	15.5
60	71.3	185.9	23.3	127	37.8	145	17	25	15.1
55	71.1	190.8	24.0	137	38.4	145	15	25	14.6
50	70.9	193.6	24.3	141	38.7	145	14	25	14.0
45	70.8	197.7	24.7	147	38.9	145	12	24	13.4
40	70.6	199.1	26.0	148	39.2	135	12	24	13.1
35	70.4	202.4	27.0	154	40.0	135	12	23	12.8
30	70.2	207.2	27.7	154	40.2	135	11	21	12.4
25	69.9	209.5	28.2	163	40.9	135	10	20	11.9
20	69.7	214.5	29.5	167	41.5	134	10	17	11.3
15	69.4	220.5	30.3	178	42.4	115	9	13	10.1
10	68.9	225.5	31.2	180	43.1	115	8	11	7.4
5	67.9	242.0	32.2	203	44.9	100	8	10	6.2
1	66.0	248.6	35.0	223	47.2	100	7	8	4.0
N	49	50	50	50	50	48	47	47	48
X̄	70.9	196.3	25.3	143	39.2	144	15	23	13.7
SD	2.0	22.1	4.2	31	2.9	21	6	7	4.0

[1] Press = maximum one repetition bench press; [2] Flex = flexibility sit and reach.

——— Sedentary average
•••••• Sheriff's Department and Highway Patrolmen

fitness. Thus, the low values for cardiorespiratory fitness found in this study may not be typical of police throughout the country. Even so, the need for further development in physical fitness and attention to factors related to risk of coronary heart disease in police officers is well documented in this investigation.

Summary

Two hundred thirteen male police officers between 21 and 52 years of age volunteered to participate in a physical evaluation and conditioning program. Information concerning risk of coronary heart disease and physical fitness status of police officers were shown. Younger police officers below 30 years of age tended to be of average risk for coronary heart disease and average in physical fitness compared to the normal population. Middle-aged police officers were shown to be at higher risk and lower in physical fitness than the normal population. The results from this investigation support the need for physical fitness and preventive medicine programs for police officers.

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CHAPTER 4

DESCRIPTIONS OF THE TWENTY WEEK EXPERIMENTAL EXERCISE PROGRAMS

Several studies have indicated a relationship between physical activity and reduced susceptibility to coronary heart disease (1, 2, 3, 4, 5, 6). Although there are some conflicting views, recent studies by Morris _et al_. (5), Paffenbarger and Hale (6), and Cooper _et al_. (1) have placed stronger evidence in favor of the role exercise plays in preventive medicine. Morris _et al_. (5) in studying the leisure-time habits of over 16,000 male, executive grade civil servants from 40 to 64 years of age, concluded that vigorous exercise apparently protected them against sudden fatal heart attacks and other first clinical attacks of coronary heart disease. The study by Paffenbarger and Hale (6) on 6,351 longshoremen, 35 to 75 years of age, found that the workers classified in a high caloric output job task had significantly lower death rates from coronary heart disease. Cooper _et al_. (1) in a cross-sectional study on 3,000 men, found a significant relationship between level of cardiorespiratory fitness and selected risk factors and fitness variables (serum cholesterol, trigylcerides, glucose and uric acid, systolic blood pressure, percent body fat and weight, resting heart rate, and forced vital capacity).

Therefore, the exercise programs utilized in this study were designed to determine if exercise conducted over a given period of time, twenty weeks, would improve cardiorespiratory fitness, the relationship of selected risk factors and fitness variables.

We were also interested in the level of improvement shown with subjects engaged in various exercise regimens including a program using minimal equipment and facilities.

The exercise programs for both the young and middle-aged officers were conducted over a twenty week period of time. All officers exercised 3 days per week for approximately 45 minutes per exercise session. The first 15 minutes of the workout was devoted to a standard warm-up period involving various stretching and calisthenic exercises completed in the following order:*

1. Jumping Jacks (20 reps)
2. Pushups (20 reps)
3. Situps (30 reps)
4. Squats (10 reps)
5. Pullups (5 reps positive or negative)
6. Back stretch (30 sec)
7. Side stretch (5 reps each side)
8. Double arm circles and toe raise (20 reps)
9. Trunk rotation (5 reps each direction)
10. Forward bend (10 reps)
11. Front leg stretch (30 sec)
12. Hamstring stretch (30 sec)
13. Calf stretch (30 sec)

The above repetitions and/or times were recommended to the officers; however, each officer recorded his exact repetitions and/or time for each warm-up exercise.

The remaining 30 minutes of each workout were devoted to the specific exercise prescribed for each group. The following describes each exercise program:

1. RPD and TDPS Program - The purpose of this program was to evaluate

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*Refer to Chapter 11 for complete description of these exercises.

a general aerobics program into a small police unit with minimal equipment and facilities. The aerobic program consisted of walking and jogging on a 440-yard marked path on a grass field area. The path was located in one of the Richardson City Parks and traversed in and out of trees. Several turns were designed for the jogging path in an effort to avoid the monotony often encountered when training on oval tracks. Initially, the walking and jogging distances were equal, but the training progressed throughout the twenty weeks in such a fashion that the individuals walked less and jogged longer distances, for example, jog one mile, walk 110 yards, jog one mile.

2. DPD Young Officer Running Programs - The purpose of this particular program was to compare interval, continuous, and combined interval/continuous running program to determine the mode of aerobic exercise which best improves the physiological functioning of young police officers.

   The aerobic programs consisted of either interval running, continuous running, or combined interval/continuous running on an oval 440 yard cinder track.

   A. Interval Program - This group alternated short periods of high intensity work (running) and low intensity work (walking). Essentially, the training consisted of walking 220 yards and then running 220 yards at high speed.

   B. Continuous Program - This group walked and jogged equal distances initially, but progressed throughout the twenty weeks in such a fashion that the individuals walked less and jogged longer distances. The final few weeks of training were essentially continuous jogging for the exercise period.

C. Combined Program - This group alternated days of training in the interval program with those of the continuous program.

3. DPD Young Officer Weight Training Program - The purpose of this program was to evaluate the effects of a weight training regimen on the cardiovascular-respiratory (CR) function and muscular strength levels of young police officers. The intent was to elicit both CR and strength gains by designing a weight training program using relatively light weights lifted several times and with minimal rest.

This group exercised in a program of weight training. The weights were adjusted so that each individual was working at approximately 50 percent of his one-repetition maximum strength and the repetitions progressed from 10 to 20 per set for the first six weeks, and then reduced to 15 per set for the remaining fourteen weeks. It was found that 20 repetitions per set was too uncomfortable for the officers. The individual moved in a continuous fashion from one exercise to another with a rest period between sets of 30 seconds for the first five weeks. Thereafter, the rest period decreased to 25 and finally to 20 seconds between each set. The above protocol, using relatively light weights, several repetitions, and minimal rest between sets was designed to determine if cardiovascular-respiratory improvements could be elicited by such a program. The following weight training, stationary cycling, and calisthenic exercises were performed in each workout:*

A. Cycling at 900 kpm/min for 2 minutes
B. Bench Press
C. Knee Extensions
D. Hamstring Curl
E. Biceps Curl
F. Dips
G. Leg Press
H. Situps
I. Shoulder Press
J. Lat Pull
K. Upright Rowing

4. DPD Middle-aged Programs - These programs were designed to elicit information similar to that sought from the younger officer running program. The main difference here was to determine the total training effect on older men.

The programs consisted of walking and jogging routines similar to that described for the RPD and TDPS program.

A. Supervised Program - This group exercised on an oval 440-yard cinder track under direct supervision of exercise leaders conducting this study.

B. Unsupervised Program - This group exercised under direct supervision for the first four weeks of the study and, thereafter, were required to train on their own at locations of their choice other than the central location where supervision was available. However, every two weeks this group was required to return to the central location for one exercise session under supervision to check training progress.

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*Refer to Chapter 11 for detailed explanation of these exercises.

In order to estimate the intensity of exercise, all officers in the exercise programs were asked to record their heart rates by the palpation technique (7) at the middle (15 minutes) and end (30 minutes) of each workout. In order to quantify the training of the running programs, the distances and times of the walking and jogging segments were recorded for each workout. For example, an individual may have recorded 0.75 mile walking in 12 minutes and 2.0 miles jogging in 18 minutes. In this way, the energy cost for the total workout could be calculated. In the DPD young officer running programs, the distances and paces of running and walking were designed so that the total calorie cost for the three programs was approximately the same. The weight training program was quantified by recording the number of repetitions and weight used for each exercise. For example, a person may have recorded two sets of 15 repetitions in the bench press using 120 pounds.

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CHAPTER 5

RESULTS AND DISCUSSION OF THE TWENTY WEEK EXPERIMENTAL EXERCISE PROGRAMS

Physiological Test Results from Richardson Police Department and Texas Department of Public Safety Program

The training group significantly decreased their resting heart rate and recovery heart rate from the three minute step test. As a result of training the heart is stronger, pumps more blood per beat, is more efficient and therefore does not beat as rapidly at rest and during submaximal work. None of the other comparisons between the control and training groups in blood pressure, blood variables, or lung volumes was statistically significant. This is not surprising since other studies have shown no changes in these variables when initial values are normal as were the values for the control and training groups. Only when initial values are abnormally high for blood pressure and serum lipids are there significant reductions in these variables with endurance exercise. Such was the case in the training group for one individual who had abnormally high triglycerides initially and reduced them towards normal during the exercise program. The initial difference in triglycerides between the control and training groups was due to this one individual.

Very significant improvements in maximum cardiovascular-respiratory testing were seen in treadmill performance time (TMT), maximum oxygen intake ($\dot{V}O_2$ max), maximum pulmonary ventilation ($\dot{V}_E$ max), and maximum oxygen pulse (max O_2 pulse) for the training group. Initially, the $\dot{V}O_2$ max for the training group was in the "average" fitness category and through the twenty week program this group improved to a "good" level of fitness. It is well known that TMT and $\dot{V}O_2$ max are improved through programs of jogging and are reflective of improvement in maximum CR function. Having an increased working capacity would be desirable for an officer since he would be able to run faster and longer if required to chase a suspect. Having an increased ability to take in and utilize oxygen is also a desirable outcome of training. This indicates that many functions of the body are enhanced and the individual is in a better state of total health. The maximum heart rate and blood lactic acid levels did not differ significantly between the groups; however, they are of sufficient magnitude to reflect a true maximum effort by the participants during the treadmill test.

Body weight did not change significantly for the training group but percent body fat, fat weight, and total skinfold fat (TSF) showed significant reductions. The slight gain in lean body weight by the training group was not significantly different when compared to the slight loss in lean weight by the control group. However, an important principle is demonstrated here by the training group; that is, while body fat is significantly reduced through programs of running, lean body weight may remain the same or increase slightly. Thus, total body weight may not change at all. This supports the important need for taking body composition measures when evaluating effects of exercise programs. Abdomen, waist, and gluteal girths of the training group showed statistically significant reductions when compared to the increases in the control group. It must be recognized that the variability (standard deviation) for the girth measures within the groups is quite large and the reductions by the training group are considered modest but significant.

The number of situps performed in one minute and the Illinois Agility Run results showed significant improvements for the training group. These reflect improved abilities for muscular endurance, speed and agility. Improvements in flexibility were expected particularly because stretching exercises were included in the warmup routine. However, as indicated in Chapter 3, the young officers had good levels of flexibility prior to program implementation. It is difficult to improve upon a fitness element that is already well-developed. The results from the Richardson Agility Course testing indicated a definite trend in improvement for the training group. However, the only statistically significant changes observed were in the 440-yard run and total time. The environmental temperature was significantly higher during the final testing session and could have affected the results. In any case, the specificity of running training is reflected through improvement in the 440-yard running performance test. The obstacle course, body drag, and stair run items of the test require short bursts of intense activity. This type of training was not included in the Richardson training program. Perhaps the inclusion of weight training and sprinting or other specific exercises relating to the obstacle course, body drag, and stair run would have produced even more changes than were observed in those tests. If these items are considered highly related to job performance by the police departments, then specific exercises that affect these physical tasks should be provided. A comprehensive program of weight training, sprinting, and distance running would seem to be the optimal program for the young officer.

The goal throughout the twenty week study was to maintain a heart rate intensity level of at least 85 percent of maximum during the training. There was a slight drop in heart rate intensity from 90 percent to 87 percent at week 17 and is attributed to the increase in jogging distance and decrease in walking distance per workout. This, however, did not result in a longer total distance per workout for the participant. Nevertheless, the heart rate intensity and calorie expenditure during this time were sufficiently high to induce a "training effect" (improvement in physiological function).

The exercise program implemented within this department was considered successful demonstrating that a general calisthenics running program can significantly improve the fitness levels of police officers. Equipment and facilities need not be extensive except, perhaps, the inclusion of weight training apparatus for improving stength.

Physiological Test Results from Dallas Police Department Young Officer Running Programs

The purpose of this particular phase of the project was to compare interval, continuous, and combined interval/continuous running programs to determine the mode of aerobic exercise which best improves the physiological functioning of young police officers.

When compared to the control group, significant reductions were seen in resting heart rate and step test recovery heart rate for the continuous, interval, and combined running groups. These results are expected for running programs. None of the small differences among the three training groups was statistically significant. Again, as previously reported, blood pressures are not expected to change when initial values are normal as in the case with these groups.

An extremely large improvement of 3 minutes in treadmill performance time (TMT) was seen for the continuous running group. This was significantly greater than the changes made by the interval and combined groups as well as the control group. Likewise, the interval and combined groups improved significantly when compared to the control group. This clear superiority in TMT by the continuous group is somewhat surprising since the improvements in maximum oxygen intake ($\dot{V}O_2$ max) and other variables were similar for all three groups. In any case, highly significant improvements in TMT, $\dot{V}O_2$ max, and maximum oxygen pulse were seen for the three running groups which reflect an enhanced CR function. The continuous, interval, and combined groups improved 15 percent, 12 percent, and 10 percent, respectively, in $\dot{V}O_2$ max. As reported in the Richardson results, the maximum heart rate and blood lactic acid levels did not differ significantly among the groups; however, they are of sufficient magnitude to reflect a true maximum effort by the participants during the treadmill test. It is interesting to note the variable nature of maximum heart rate (MHR) among the groups. The continuous and combined groups showed reductions which agrees with previous findings, yet the interval group remained the same. Perhaps the specificity of training is operative here when it was observed that the interval group trained at a slightly higher heart rate intensity than the other two groups, thus stimulating an inducement of a near-maximal heart rate on a regular basis.

Significant reductions were made in percent body fat, fat weight, and total skinfold fat by the three training groups when compared to the slight increases by the control group. None of the reductions among the three training groups was statistically different when compared to each other. As shown in the Richardson program, there was a trend for a slight increase in lean body weight with a slight reduction in total body weight for the exercise groups; however, the changes are not statistically different from those for the control group. These results emphasize the importance of running programs for reducing body fat while increasing or maintaining lean body weight. The abdomen, waist, and gluteal girth changes were similar to those observed in the Richardson program. The changes are considered modest but statistically significant.

The motor ability results showed significant improvements for all three running groups in situp performance and for the continuous and combined groups in pushup performance. These improvements are obviously due to the fact that situps and pushups were part of the daily warmup routine for the exercise groups. The improvements in pushups by the interval group and the improvements in bench press by all three running groups were marginal when compared to the control group. These trends of improvement though reflect the importance of including calisthenics to supplement the daily aerobics program. Again, the lack of improvement in flexibility was thought to be due to the high values of the officers initially. Improvements in agility run time was not seen in these running groups as was observed in the Richardson program. Inconsistencies in data collection on this variable and the vertical jump test were observed in the Dallas program due to the large number of officers tested by different staff members.

The pulmonary function and blood variables for this study indicated all values are normal and the small changes observed from initial to final testing sessions were non-significant. With regard to the blood variables, other research has shown that serum lipids are reduced by exercise programs only when values are abnormally high initially.

An effort was made to design all the training programs so that calorie cost was similar throughout the twenty week period. This was accomplished remarkably well for the continuous and interval groups; however, the calorie expenditure for the combined group was higher. This was due to the fact that the combined group was 18 and 23 pounds heavier than the continuous and interval groups, respectively.

Because of the considerable amount of walking involved in the interval program in comparison to the continuous program during the latter weeks of training (walk 220 yards, run 220 yards), the total time per workout and total distance were increased considerably over the continuous program to achieve a similar calorie expenditure. The heart rate intensity of the interval program was higher than the others presumably because of the very fast running speeds required of those officers.

In summary, there was no clear superiority of one running program over another with the exception of the three minute improvement in TMT by the continuous group. When total calorie expenditure is similar, all three training regimens resulted in similar physiological improvements. It appears, then, that any of the three modes would be successful for improving the physical fitness of police officers. However, when officers in the combined group were asked for their preference of running mode, most (80 percent) chose the continuous workouts. Also, less discomfort, fewer injuries, and lower dropout rates were experienced by the continuous program; thus, it is recommended as the preferred running program for young police officers.

Physiological Test Results from Dallas Police Department Young Officer Weight Training Program

Although the major purpose of this phase of the study was to examine specifically the phsyiological effects of a weight training program, the results from the continuous running program and control group are reported here for comparative purposes.

A trend for reducing step test recovery heart rate was seen for the weight training group but the change was not significant with respect to the control group. The continuous running group improved significantly in resting heart rate and step test recovery heart rate when compared to both the weight training and control groups. Thus, the weight training program used in this study did not affect significantly resting or submaximal cardiovascular function. Blood pressures are normal for all groups and were not expected to change.

The weight training group improved significantly when compared to the control group in treadmill performance time (TMT), maximum oxygen intake ($\dot{V}O_2$ max), and maximum oxygen pulse (max O_2 pulse). This statistical significance occurred because the control group decreased 12 seconds in TMT, 1.2 ml/kg·min in $\dot{V}O_2$ max, and 0.2 ml/beat in max O_2 pulse while the weight training group increased 43 seconds in TMT, 1.4 ml/kg·min in $\dot{V}O_2$ max, and

0.9 ml/beat in max O_2 pulse from initial to final results. The changes in these variables for the weight training group represent 10 percent, 3.5 percent, and 5 percent improvements, respectively, over the twenty week period. These are minimal changes when compared to the improvements made by the continuous running group; 38 percent in TMT, 15 percent in $\dot{V}O_2$ max, and 19 percent in max O_2 pulse. Only the 10 percent improvement in TMT by the weight training group approaches physiological significance. The improved running performance is probably partially explained by the increased leg strength gained through the weight training. Little evidence is available showing the effects of weight training on cardiorespiratory function. Wilmore and Davis (2) reported small but statistically significant improvements in $\dot{V}O_2$ max during ten weeks of weight training for women, which agrees with our findings. On the other hand, Allen et al. (1) found no changes in heart rate, blood pressure cardiac output, stroke volume or $\dot{V}O_2$ max with a twelve week program of weight training. Differences exist between our study and those of Wilmore and Davis and Allen in length of study, repetitions per set, number of sets, and rest interval between sets. However, these studies all indicate that cardiorespiratory changes are questionable in weight training programs as conducted in this experiment, i.e., using light weights with high repetitions and little rest between exercises.

The weight training and continuous running groups were administered mid-term tests after ten weeks to ascertain the magnitude of change halfway through the training. After ten weeks the weight training group had improved 3 percent, 3.75 percent, and 6 percent in TMT, $\dot{V}O_2$ max, and max O_2 pulse, respectively. Essentially, this group reached its magnitude of change in

$\dot{V}O_2$ max and max O_2 pulse at ten weeks but not in TMT. Most of the improvement in TMT occurred during the latter ten weeks of training. The continuous running group, on the other hand, had improved 20 percent in TMT, 8 percent in $\dot{V}O_2$ max, and 13 percent in max O_2 pulse after the first ten weeks of training. These represented more than half of their total improvements for the twenty week period.

No significant changes among the three groups were seen with maximum pulmonary ventilation, maximum heart rate or blood lactic acid levels. This concurs with the findings in the Richardson and Dallas Police Department young officer running programs. The values are sufficiently high to verify the maximum effort by the participants.

Statistically significant reductions in body fat, total skinfold fat, and abdomen, waist and gluteal girths occurred in the weight training group over the twenty week period when compared to the control group. As with some of the cardiorespiratory findings, the significances were a result of the combination effect of the control group increasing slightly in the variables while the weight training group decreased slightly. After twenty weeks of training, changes in percent body fat, fat weight, and total skinfold fat represented 6 percent, 5 percent, and 10 percent reductions, respectively. The running group reduced 10 percent, 11 percent, and 14 percent, respectively, in these variables. Mid-term test results in the three variables indicated 1 percent, 1 percent, and 2 percent reductions in the weight training group while the running group improved 6 percent, 5 percent, and 8 percent, respectively. Although the trend for reducing fat in the weight training group was evident, the changes are of lesser physiological significance when compared to the running group. The variability (standard deviation) in the weight training group was much higher than the other two groups which further complicates the interpretation of statistical vs physiological significance. This latter concept is particularly evident in the abdomen, waist and gluteal girth measures where modest reductions were observed.

Lean body weight increased 2 percent in both training groups which was not significantly different from the slight increase in the control group. No significant changes in total body weight were observed among the three groups. The principle demonstrated here is that while body fat is reduced with exercise, lean body weight increases slightly so that total body weight remains essentially the same.

The principle of specificity of training is quite evident when examining the results of muscular strength. The situp and pushup performance of both the weight training and running groups improved significantly over that of the control group primarily because these two calisthenic exercises were included in the warmup routine. Changes in flexibility, vertical jump, and agility run were not significant and those reasons were discussed in the Richardson and running program sections. Highly signficant improvements in bench press and leg press strength were observed for the weight training group when compared to both the control and running groups. Changes of 33 percent, 43 percent, 26 percent, and 39 percent were seen for the weight training group in isotonic bench press, isokinetic leg press-slow, isokinetic bench press-slow, and isokinetic bench press-fast, respectively. In contrast, the changes for the running group were 13 percent, 35 percent, 14 percent, and 25 percent and 1 percent, 25 percent, 13 percent, and 20 percent, respectively for the control group. The differences between the running and control groups were non-signficant except for the isokinetic leg press-slow test where the running group changes were significantly greater. The improvements by the control group are explainable by the learning process in strength testing. The learning process is operative in the running and weight training results also, thus demonstrating the need for a control group in comparative studies of this nature. The improvements due to familiarization of strength testing techniques are assumed to be constant among the groups; therefore the improvements seen above and beyond the learning process (represented by the control group) are physiological improvements in strength.

One important facet of evaluating the effects of a weight training program is the quantification of the work performed. Representative weeks were chosen to demonstrate the progression in training. The rest time interval between sets decreased from 30 seconds, initially, to 25 and later to 20 seconds. Thus the total time of each workout progessively decreased from 29 to 23 minutes. It was discovered during the fifth and sixth weeks that 20 repetitions per set was too difficult for the individuals to perform when training resistance was regulated at 40 to 50 percent of maximum strength. Therefore, the repetitions were reduced to 15 per set. The heart rate intensity remained fairly high and compares favorably with that in the running programs presented previously. Of notable significance is the progressive increase in the amount of weight resistance used in the training and the officers' abilities to train at a progressively higher percentage of maximum strength throughout the study.

Im summary, the results from the weight training study indicated that cardiovascular-respiratory (CR) function was not significantly improved as originally intended. However, treadmill performance time, body composition, strength, and muscular endurance measures were significantly improved. The specificty of training principle is demonstrated here, i.e., strength gains are evident primarily from a weight training program and CR gains are evident primarily from running programs. Thus, a combination of running and weight training is recommended to the young police officer for attaining both CR and strength improvements.

Physiological Test Results from Dallas Police Department Supervised/Unsupervised Programs

Both the supervised (SV) and unsupervised (US) groups improved significantly in resting heart rate and step test recovery heart rate as compared to the control group. No differences were seen in these variables between the SV and US programs. The changes in heart rates among the exercise groups and normality of blood pressures agree with findings reported in the Richardson and Dallas running programs.

The improvements in maximum cardiovascular-respiratory (CR) function also concur with the findings from the Richardson and Dallas running programs. Both the SV and US improved significantly in treadmill performance time (TMT), maximum oxygen intake ($\dot{V}O_2$ max), and maximum oxygen pulse (max O_2 pulse); 13 percent, 20 percent, and 19 percent, respectively for the SV group and 12 percent, 22 percent, and 22 percent, respectively for the US group. Initially, the $\dot{V}O_2$ max level for the middle-aged officers was lower than average. After the exercise program had been completed the officers in the two training groups had improved to high average and above average fitness levels. Unlike the young officers in the exercise programs, the middle-aged officers in the SV and US groups showed significant reductions in maximum heart rate (-5 beats/min) in comparison to the increase of 5 beats/min in the control group. The maximum pulmonary ventilation and blood lactic acid levels were not significantly different among the groups. This was also seen in the young running study.

The SV group was the only exercise group among the police officer studies to show a statistically significant reduction in total body weight. A trend in this direction was seen for the US group but the change did not reach statistical significance. The greater loss of body weight in the SV group was probably due to the significantly greater attendance record compared to the US group. Thus the total number of calories expended over the twenty week period was greater for the SV group.

The loss of body weight by these groups was due mainly to the loss in body fat. Percent body fat, fat weight, and total skinfold fat losses averaged 12 percent, 15 percent, and 13 percent, respectively for the SV group and 10 percent, 11 percent, and 11 percent, respectively for the US group. All of these changes were statistically significant. Because of the large variability (standard deviation) among the groups in lean body weight the small changes observed were non-significant. It was previously explained that the reduction in waist girth for the young exercise groups was modest but statistically significant when compared to the slight increase in the control group. The same was true for the middle-aged officers in the SV and US groups except that the waist girth reductions were very significant (-1.4 inches).

Trends of improvement were seen in situp and pushup performance and bench press strength for the SV and US groups but the changes did not reach statistically significant levels. Improvements in flexibility were expected but did not occur even though the initial levels were below average.

The pulmonary function and blood variables for the middle-aged officers showed the same results as the young officers; none of the differences among the groups was statistically significant. It appears that the cholesterol and triglyceride levels in the SV and US groups showed significant reductions; however, further examination revealed that two individuals had extremely high values initially and reduced them towards normality in the twenty week program. This created extremely high variance measurements for these tests and confounded the statistical comparisons.

It is interesting to note that although the US group had a significantly lower attendance record (43 workouts/subject) than the SV group (54 workouts/subject) their average calorie expenditures per workout was slightly higher. This was partly due to the fact that the US group was slightly heavier in body weight and weight is involved in the calculation of the energy cost of walking and jogging. The average distance, total time per workout and training heart rate intensities were similar for the two exercise groups. As previously mentioned the total calorie cost over the entire twenty week period was greater for the SV group due to the higher attendance record.

In summary, no significant differences were found between the SV and US training programs in eliciting CR and body composition improvements even though the SV group had a higher attendance record. It was concluded that endurance training elicited significant improvements in the physical fitness of middle-aged police officers regardless of supervision.

Summary of Physiological Findings

The various exercise programs implemented within the police departments significantly affected the participating officers. The RPD and TDPS exercise program was successful in eliciting improvements in resting and submaximal cardiovascular function, maximal cardiovascular-respiratory function, body composition, muscular endurance and agility. It proved that a general calisthenics and running program using little or no equipment is sufficient to produce desirable results in physical fitness. If possible, the inclusion of weight training would help to improve the strength of the participating officers.

The DPD Young Officer Running Program showed that continuous running, interval running, and combined continous/interval running programs were remarkably similar in improving physical fitness. So long as the total calorie expenditure is similar, the three programs are of equal value in eliciting physiological improvements. The continuous running program is recommended based on the personal preference of the participating officers and the fewer problems of injury and dropout experienced in that program.

Results from the DPD Weight Training Program indicated that cardiovascular-respiratory function was not affected. However, treadmill performance time, body composition, strength, and muscular endurance measures were significantly improved. The specificity of training principle showed that the weight training program resulted primarily in strength gains while the running programs resulted in CR improvements. Therefore, a combination of running and weight training is recommended to achieve both CR and strength improvements.

The physiological changes observed on the DPD middle-aged runners were in desirable directions resulting in improved physical fitness. These changes were observed regardless of supervision after the initial orientation to exercise. This indicates that fitness programs can be decentralized successfully. Several programs based on individual preference can be conducted in police substations located throughout a metropolitan area. The major consideration is to initially provide close supervision for each participant and then rely on the continuing personal program.

Attrition

The overall attrition rate (45 percent) for the exercise groups in all programs was much higher than previously reported for similar exercise programs. Of particular note is the extremely high dropout rates for the interval and combined running groups; 60 percent and 58 percent, respectively. Injury was not a significant attrition factor for these groups; only 8 percent and 12 percent respectively, dropped out of those groups due to injuries.

Only the Richardson training group and the Dallas combined running group indicated a relatively high injury rate (19 percent) among those who finished the program.

Other factors influencing the attrition rate were investigated. Questions were asked concerning whether the dropouts enjoyed the training, enjoyed their group assignment, had a second job, and went to school. Average number of training weeks completed, distance from home and work to exercise center, number of trips from home and work to exercise center, and specific reasons for dropping were also tabulated. Of the total number (n=66) of dropouts from the exercise programs, 57 or 86 percent responded to the attrition questionnaire.

Only a few of the respondents indicated dissatisfaction with the training or their group assignment. Most of the officers dissatisfied with their group assignment were from the Dallas interval running program which was the most unpopular of the experimental exercise programs. Thirty percent of the dropouts had a second job and 30 percent attended school, however, the most common reason for dropping was "too much time involved" in the exercise program. Rotating shifts were apparently not a problem since only 30 percent of all dropouts were on that schedule.

A variety of reasons combined to account for the rather high dropout rate for the young officers in the various exercise programs. Those reasons included the following: personal reasons, too many work hours, illness in family, personal illness (mainly colds and flu), extensive court appearances, new babies in family, poor training facilities, distance too far, and gas too expensive. Many of the young officers estimated that two or three hours of their day were required to travel to the exercise center, work out, shower, dress and go to work or return home. Even though the program was conducted only three days per week, the dropouts felt the program required too much of their personal time.

The dropout rate (41 percent) for the middle-aged officers in the exercise programs was slightly lower compared to the young officers (46 percent). The middle-aged dropouts also had a variety of reasons for dropping including too much time, lack of interest, family illness, personal problems, and interferes with job. Several of the middle-aged officers were transferred to other divisions during the study and many dropped the program claiming that their new job required too much time.

The most unpopular training program was interval running. To gain further insight into this aspect, officers in the combined group who completed the program were asked which training they preferred, continuous or interval running. Most (80 percent) preferred the continuous running, 10 percent preferred the interval, and 10 percent enjoyed both. Of the three programs (continuous, interval, or combined), it appears that the continuous running is the preferred regimen.

In order to gain some insight on the motivational factors involved in the exercise programs, officers who finished the program were asked questions concerning their motivation. The officers indicated they recognized the need for a regular exercise program to "get in shape" and "lose weight." Also evident was the recognition of the need for a supervised program. Most of the finishers enjoyed the exercise and saw improvements within themselves.

The major reason given for the high attrition rate involved "too much time" for the programs. Several reasons contributed to this factor and included holding second jobs, attending school, distance to exercise center, family and person illness, several court appearances, new babies in family, expense of traveling to exercise center, lack of interest, and some injuries. No one reason stood out as being significant but all combined to result in "too much time" required for the exercise programs even though they were held only three days per week. This situation is somewhat perplexing since a similar number of officers who finished the exercise programs held second jobs, attended school, traveled comparable distances, incurred the same expenses, had court appearances, and experienced some injuries. Several young officers felt that exercise programs should be mandatory and that on-duty time should be allowedfor such exercise since it is a vital part of an officer's job.

An additional factor which contributed to the attrition rate was revealed in personal interviews with dropouts from the experimental program. This factor was the "experimental" nature of the exercise programs. All officers who volunteered to participate in the program were asked to complete 60 full workouts; that is, 3 workouts per week for 20 weeks. In the event that a workout was missed for any reason, the officer was asked to make up the exercise session. Many of the officers fell so far behind that they found it easier to drop out than attempt to catch up with the other members of their group.

At least two of the dropouts interviewed indicated that they found the exercise regimen to be too demanding when it was increased to a higher level. In other words, as the jogging pace or distance was increased, they did not feel physically capable to exercise at the higher level. Therefore they dropped out of the program rather than exercise at a pace which made them feel uncomfortable. Motivational recommendations for fitness programs are discussed in Chapter 8.

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CHAPTER 6

ATTITUDES AND PERCEPTIONS TOWARD HEALTH AND PHYSICAL FITNESS

A great variety of psychological benefits are attributed to improved health and physical fitness. The objective of this segment of the research project was the determination of psychological factors relating to the police environment and physical fitness. We were interested in the officer's perception of his physical abilities, opinion relating to current physical standards for the police occupation, his opinion on health, sources of stress, anxiety, and attitudes toward physical fitness. Specifically, we sought the identification of any changes in these factors which occurred across the twenty weeks of training.

It was believed that by identifying these factors we would provide information to the administrator which would be beneficial in planning and operating a physical fitness program.

A series of pen and pencil instruments were administered to the volunteer subjects prior to their initial evaluation at the Institute for Aerobics Research, at midpoint in the exercise program and at the end of the twenty week exercise regimen. A great deal of perceptual data was included in this portion of the study. However, only that information which may be of significance in implementing a physical fitness program is reported.

The Medical History Questionnaire was completed only at the beginning of the program and was utilized in the analysis of the CHD risk factors for police officers.

Background Information - Request Form

This instrument provided information concerning personal information, physical fitness activities and family patterns of exercise, and was administered only at the beginning of the program.

General Information

The majority of the officers participating in these programs were married, had attended college and were generally assigned to patrol or investigations. Older officers were generally of higher rank within the department and held administrative or mid-management positions.

Although most of the officers participated in sports while in high school, less than one-third engaged in any organized sports at the time of the study. Those who indicated current participation in sports preferred bowling and golf. While there is no evidence to show diminished interests in active sports participation, one conclusion might be the nature of the physical education classes men in this age group encountered in their school years. Until recently, most physical education classes were centered around the seasonal team sports of football, basketball and baseball. There was little, if any, indoctrination and instruction provided in lifetime sport activities such as tennis, handball, squash, or running. When an individual graduated from school there were only a limited number of sports he could continue to play, generally softball and basketball. If these were not of particular interest to him, he generally fell into a spectator role or lost interest in sports altogether.

Physical Fitness and Job-Related Questionnaire

Given the general profile of the officers, we sought information concerning how physically fit the officers felt they were and if their perceptions of their conditions would change after participating in an intensive exercise program. We were specifically interested in their opinions of how well they performed police-related tasks compared to other officers of their age group. The officers were asked to respond how often they performed nine job-related activities: (1) chasing a fleeing suspect on foot; (2) climbing a fence; (3) running up a flight of stairs; (4) pushing a stalled car by hand; (5) lifting a sick or injured person; (6) struggling with a resisting suspect; (7) separating two or more fighters; (8) climbing a ladder and; (9) lifting a heavy object.

The majority of officers reported performance of these activities "rarely" or "never" at both pre-test and post-test administration. Among the activities most frequently performed were struggling with a resisting suspect, running up stairs and lifting a heavy object or person.

Even though these physical activities are infrequently performed, most officers felt they possessed the necessary physical skills and abilities required for these activities. When asked to rate specific physical skills in comparison to other officers of the same age, nearly all officers in every group rated themselves at least average, even before the training programs began. When comparing these responses to the actual physical condition of these subjects shown in Chapter 3, these responses are considered inflated. However, substantial gains in the self-ratings following the twenty-week

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program reflect the actual improvements of these officers in cardiorespiratory fitness and work capacity. Nearly all of the officers who saw themselves as below average at the outset of the program rated themselves at least average by the end of the training program. Only two officers provided self-ratings of below average at the end of the program.

It is apparent that perceptions of physical abilities increased after completing the training programs. Perceived endurance increased to the greatest extent, which is expected as the result of an aerobics program.

Entry Level Medical and Physical Agility Standards

Officers were asked to rate the difficulty of entrance level medical and physical agility standards. The intention here was to determine if officers believed the standards required for police applicants were important in their current assignments.

At the pre-test officers in the Richardson Police Department and Texas Department of Public Safety rated the entrance level medical exams as easy; nearly all officers felt capable of passing the standards and two-thirds considered these medical standards important. Similar patterns emerged from the question concerning physical agility standards. It must be remembered that these responses were given prior to the first visit to the laboratory and prior to the administration of the Richardson Agility Test. By the post-test only 25 percent of these officers considered the entrance level tests as easy although all officers indicated they could easily pass them.

In the Dallas experimental groups, 63 percent of the officers indicated they could pass the physical and medical requirements initially, while 73 percent indicated they could pass both standards by the end of the training program. There was no change in the opinion of control group officers.

These changes may result from a number of factors. Pre-test ratings were probably inflated in many cases, simply because most people feel they are physically fit. By the post-test administration, a more realistic self-appraisal can be made. This is the result of experience with fitness training and medical examination.

Health Opinions

It might be hypothesized that familiarity with heart attacks and health-related problems in others as well as the experiences gained through participation in the physical fitness training programs would increase one's own concern about health. Attitudes toward personal health and physical fitness were explored in the Health Opinion Questionnaire.

There are indications that officers in the Richardson/DPS program became slightly less concerned about both their health and their ability to control it, slightly less concerned about the possibility of heart attacks, and slightly more sure of their physical fitness over the twenty-week program. Officers also reported feeling more physically fit at the post-test administration but showed a significant decrease in concern over their general health.

Among Dallas police officers, the patterns of response are clearer. While younger control group officers remained consistent in their self-evaluations of health and physical fitness, younger officers in the experimental group felt significantly more physically fit at the end of the training program.

Self-evaluations for older Dallas officers in the experimental group increased significantly. By the end of the experimental program, these officers felt significantly more physically fit and were significantly less concerned about having a heart attack within the next ten years.

It would appear, then, that training programs increased participants' feelings of well-being in terms of perceived physical fitness and decreased their fear about possible heart attacks. It should be noted that certain of these self-ratings were high for all groups of officers at all test administrations. For example, all officers rated their health as better than fair in comparison to other officers their own age. Finally, all officers exhibited moderate to high perceptions of personal control over health.

These attitudes were reflected in responses to fifteen opinion questions concerning a variety of health-related issues which were included on the Health Opinion Questionnaire. A high degree of consistency of opinion was found among all officers. The majority of responding officers in all groups agreed with four of the statements and disagreed with eight of the statements at all three test administrations. Officers agreed with the following:

- Doctors today know a lot more about how to prevent and treat sickness than doctors did 25 years ago.
- More tax money should be spent on medical research.
- It is quite possible to prevent many kinds of heart attacks.
- By taking certain health actions, a person can generally prevent a heart attack.

At the same time, officers generally disagreed with the following:

- Good health is more a matter of luck than what a person does about his health.
- Most often, it's not possible to prevent sickness—if you are going to be sick—you will be sick.

- A person's health is more a matter of what is born into him than what he does about his health.
- In general, doctors today take more interest in their patients than doctors did 25 years ago.
- If you're going to have a heart attack, there is nothing you can really do to prevent it.
- Heart attacks are more a matter of bad luck than what a person does or doesn't do to prevent them.
- Heart attacks are caused more often by something born into a person than by what he does about his own health.
- There may be some things that you can do to prevent a heart attack but it really isn't worth the effort it takes.

While there are no right or wrong answers to opinion questions, it is apparent that even at the pre-test stage the officers participating in these training programs were aware of the many factors relating to health in general and heart attacks in particular, as well as of the possibilities of personal preventive care. These officers generally feel, then, that health must be actively sought and maintained and that heart attacks result at least in part from lack of attention to personal condition.

To examine officers' perceptions of the causes of heart attacks, the final questions on this instrument called for ratings of the importance of five factors in preventing heart attacks: the kinds of food you eat; amount of food you eat; amount of sleep and rest; amount of stress and tension; and amount of physical exercise.

Officers in all five groups viewed all five factors as being of some importance in preventing heart attacks. Generally, "the amount of physical activity and exercise" and "the amount of stress and tension" are seen as more important than other factors, and these two factors remain more important from pre-test to post-test for many of the participants. On the other hand, the least important factor varies from group to group and from pre-test to post-test.

Sources of Stress

An examination of perceived stress and tension provides additional insight into those factors that may bear upon an officer's medical and emotional well-being. Stress is the basic subject matter addressed in Part II of the Physical Fitness and Job-Relatedness Questionnaire. For purposes of discussion, three general sources of stress may be defined; these are the job of police officer, the effects of the job on personal life, and knowledge of problems faced by other officers.

1. The Job of Police Officer

The participating police officers see their job as a dangerous one, both physically and emotionally.

Management awareness of and willingness to help officers cope with the physical demands of the job are also sources of some stress for the participants. When asked to indicate the amount of perceived tension associated with a variety of specific police calls, participating officers responded with great consistency across department, group assignment, and time. Eleven of the eighteen situations were given ratings of at least "slightly tense;" many of these situations involve on-going activities which are highly volatile and therefore dangerous. On the other hand, situations in which officers reportedly feel somewhat relaxed are more frequently "after the fact" activities in which the action has already taken place. Officers tend to feel most relaxed during routine patrol when no specific calls for service are being received.

Overall Rank Order of Perceived Tension During
the Performance of Various Police Duties

Rank Order		
1	(Moderately Tense)	Officer needs assistance
2		Robbery in progress
3		High speed auto chase
4		Person with gun
5		Mentally disturbed person
6		Shooting
7		Child beating
8		Family fights/disturbances
9		Possible homicide
10		Unknown nature of call
11	(Slightly Tense)	Delivering death messages
12	(Slightly Relaxed)	Silent Alarms
13		Sudden death/DOA
14		Prowler
15		Taking rape reports
16		Burglary
17		Auto accidents
18	(Moderately Relaxed)	Routine patrol

Participating officers also expressed rather strong feelings about other segments of the criminal justice system and about their communities. Generally officers agreed with the following four statements:

- The courts are often too lenient with offenders.
- Many lawyers try to make officers look foolish.
- Most judges treat officers with respect.

- There is a big difference between whether a person is really guilty and whether the court says he or she is.

At the same time, officers disagreed with two statements:

- I have to spend too many hours in court.
- Juries are often prejudiced against officers.

Participating officers, then, generally feel that while judges and juries are fair, their decisions are not always the most desirable and, in addition, that lawyers do not treat officers with respect.

2. Job Effects on Personal Life

Another possible source of stress for police officers consists of the great variety of effects the job may have on personal life. These effects were also explored in this questionnaire. Officers reported having become slightly more cynical, slightly less respectful of the criminal justice system, and slightly angrier toward community leaders as a result of their experiences as police officers. Positive effects of the job were reported on friendships with other police officers, ability to stay alert, and general energy level.

At the same time, however, many differences among officers in different departments were found regarding effects of job hours on personal life for the R/DPS experimental group; ratings of work hour effect become more negative across time. Among Dallas police officers, however, the pattern was just the opposite. Ratings of work hour effect increased in positive value from pre- to post-test among the Dallas younger experimental officers. Similarly, older Dallas officers provided more positive ratings on these factors.

It is felt that these changes may largely be explained by the fact that after the programs had begun, permanent shift hours replaced monthly shift rotation schedules for the Dallas patrol officers. Working permanent hours undoubtedly has a stabilizing effect on personal and family life and, therefore, should result in more positive assessments of the factors listed.

Other questions concerning problems in family life provided indications that families may be a source of stress for some officers. Some 16 percent of the participating officers indicated that their wives/girlfriends are "displeased" or "extremely displeased" about their husbands working as police officers. In addition, while 7 percent of the officers who are parents felt that the police job had a positive effect on their children, 25 percent rated the job as having a negative effect on their children, mostly because of lack of time and of the expectations or reactions of others to the job of police officer. Finally, in connection with personal family problems, 28 percent of the officers reported having had serious problems in their marriages; 76 percent of these officers believed that the police job had a great deal to do with these problems; and 56 percent of these marriages ended in divorce.

3. Knowledge of Problems Faced by Other Officers

Problems which other police officers have encountered may also be a source of stress to the individual, particularly if these officers are personal friends or at least acquaintances.

Officers were asked to indicate how many of the five officers whom they knew best had experienced problems with alcohol, marriage, children, finances, drugs, and neighbors. At least half of the officers in all three groups have known one or more officers who have had marital and financial problems. Over half of the officers indicated that alcohol and neighbors have caused problems among some of their closest friends. While few Dallas officers indicated any of their police friends had problems with drugs, over one-third of the R/DPS officers so indicated.

Finally, the extent to which participating officers have knowledge of attempted suicides and severe or fatal heart attacks among fellow officers was explored. As is expected because of longer police careers, older officers are much more likely to have known one or more officers who have either attempted suicide or have suffered severe/fatal heart attacks. However, both R/DPS and younger Dallas officers know of attempted suicides; nearly 40 percent of R/DPS officers, and over 75 percent of younger Dallas officers have known police officers who suffered severe/fatal heart attacks. Since Dallas is a much larger department than Richardson, larger number of heart attacks are to be expected.

In all groups, the majority of officers indicated that the effects of the police job probably played a major role in the suicides and that many of the known heart attacks occurred while the victims were on duty.

Summary of Stress Data

Reviewing all of the data from Part II of the Physical Fitness and Job-Relatedness Questionnaire provides clear indications of a variety of perceived sources of stress and tension for the police officers participating in this study. These perceptions may be summarized as follows:

1. The job of police officer in general is seen as both physically and emotionally dangerous. Police department management is neither sufficiently aware nor sufficiently concerned with the physical demands placed on police officers.
2. A variety of specific calls for police service are sources of stress and tension. Among the most stressful are officer needs assistance, robbery in progress, and high-speed auto chases; least stressful situations include burglaries, auto accidents, and routine patrol.
3. Although these police officers do not spend a large amount of time in court, courts nevertheless present a certain amount of frustration, particularly in the behavior of lawyers and in the final outcome of court cases.
4. Many of the attitudinal changes traditionally associated with the police job, i.e., cynicism, anger, isolation, and lack of caring, are reported only "to a slight degree" by the participants. These officers, then, perceive themselves as little changed from when they first joined their respective departments.
5. Working hours have divergent effects on the officers in this study. While initially viewed as having an almost neutral effect on a

variety of aspects of personal life, the topic of hours worked generally decreased in positive effect for the Richardson and Public Safety Department officers and increased in positive effect for the Dallas officers. Results among Dallas participants may reflect movement from rotating to permanent shifts.

6. Family life has also been affected by the job for many of the participants. A negative effect on children was reported by one-fourth of the officer-parents; and in the majority of cases where serious marital problems were reported, the effects of the job were said to be definitive.
7. Finally, in the area of personal relationships, it was found that substantial numbers of participants have had close officer friends who have had problems with alcohol, marriage, finances, children and neighbors. In addition, most of the participants have known officers who attempted suicide or suffered heart attacks.

Anxiety and Attraction Towards Physical Fitness

Prior to initiation of the study and again at the tenth and twentieth weeks, the participating police officers completed the State-Trait Anxiety Inventory (STAI) (6) and the Physical Estimation and Attraction Scale (PEAS) (5). The STAI is designed to measure both state (transitory) and trait (enduring) anxiety, whereas, the PEAS assesses estimation of physical ability, or self-esteem, and attraction or attitude toward physical activity.

It was hypothesized that involvement in one of the exercise programs, in contrast to participation in the control group, would be associated with a decrement in state anxiety and an increase in estimation of physical ability, and, further, that *trait* anxiety and attraction toward physical activity would remain the same across the twenty-week period.

None of the groups experienced a reduction in state anxiety which contradicts the hypothesis that exercise would decrease tension. While there is evidence that *acute* physical activity decreases *state* anxiety (2), there is not a convincing body of literature which demonstrates the same to occur with chronic exercise. On the other hand, all of the groups in this study scored rather low on state anxiety in contrast to published norms (6); therefore, it is conceivable that decrements in anxiety were not possible in these relatively "low anxious" subjects.

It was hypothesized that attraction or attitude toward physical activity would not change across time, and results confirm this prediction. Therefore, since these volunteers possessed high, positive attitudes toward physical activity from the outset, it is understandable that increments did not occur; and it is also reassuring that involvement in the various exercise programs did not produce a decrease in attitude.

A different picture emerges when estimation of physical ability is examined. Each of the exercise groups had increases in their estimates of self. An improved estimate of physical ability is regarded as a positive change in affect since the way in which one views his or her own body influences his/her self-concept and self-esteem. Stability of attraction and increased estimation of physical ability was also demonstrated in the earlier studies involving prisoners (3).

Trait anxiety is felt to be a stable, enduring, psychological dimension. However, the changes in both state and trait anxiety observed in this study took place only in high-anxious officers. In other words, vigorous physical activity was associated with anxiety reduction in anxious individuals. This same finding was also observed in the earlier investigation dealing with prisoners (3).

Physical training did not differentially influence officers scoring in the extremes for the attraction or "attitude toward physical activity" measure. Individuals with high scores on the attraction measure of the PEAS remained high, and those with low scores remained low following physical training.

Similarly, those officers who possessed a high estimation of physical ability at the outset maintained these high scores across the ten weeks of training. However, those officers who scored low on the estimation scale of the PEAS at the outset, experienced a significant increase in their self-estimates following ten weeks of training.

It is recognized that the major physiological benefits occur during the first two months of training, and the same may very well be the case for psychological gains. From a clinical standpoint, however, it is clear that enormous individual differences exist with respect to training responses—both psychological and physiological.

Summary

This chapter represents a summary of the major psychological findings resulting from the physical fitness intervention program carried out with police officers. In many respects, this study was similar to earlier investigations, and for the most part, the findings of the present investigation were comparable to those reported for the prisoners (3). Interestingly, attitude toward physical activity from the outset was not useful in discriminating between officers who dropped out and those who continued.

Police officers who participated in any of the physical activity training programs experienced a significant increase in their estimation of physical ability following the twenty weeks of involvement. This must be regarded as a desirable and positive change since the way one feels about his or her own body is known to influence self-concept. It was also noted that control group officers from the same population did not experience such a change.

The various psychological analyses carried out for all groups across the twenty-week period revealed that, with the exception of the above-mentioned change, alterations in psychological states and traits did not occur. However, when officers scoring in the extremes for various variables, such as anxiety, were evaluated, it was noted that significant alterations did occur. For example, both state and trait anxiety decreased in high-anxious officers across ten weeks of training, whereas, low-anxious officers in the various exercise groups and sedentary control group officers remained unchanged. Therefore, anxiety was reduced in participants who scored high on anxiety from the outset, and this supports the common view held in the exercise sciences that such an intervention is efficacious in the management of anxiety and depression.

Evaluation of Program Participation

The final instruments to be examined in this chapter are the project participation questionnaires completed by the participating officers and their wives at the conclusion of the various twenty-week training programs. Items on these two questionnaires addressed both the administration and the results of the programs.

The majority of officers in each of the three training groups reported favorable change in amount of fatigue or tiredness, general activity level, and general physical fitness as a result of the various aerobics programs. These figures are highest for general physical fitness. Favorable changes in weight were reported by 62 percent of the R/DPS officers, 43 percent of the younger Dallas officers, and 95 percent of the older Dallas officers in the experimental groups. Similarly, ability to sleep changed favorably for the officers in these three groups. Twenty-five percent or more of each experimental group also reported favorable change in their sex lives.

These very positive results are echoed in the evaluations of officers provided by their wives. The majority of wives of training group officers reported favorable changes in their husbands' condition for four of the six factors listed, i.e., weight, amount of fatigue or tiredness, general activity level, and general physical fitness. Ability to sleep and sex life were also viewed as having changed in a favorable way.

The majority of officers in each training group report favorable changes in worry about health, self-confidence, ability to relax, and tenseness. Perhaps more surprising, however, are the rather large percentages reporting favorable change in overall job satisfaction and worry about non-health related matters, things which might not be considered as being affected by physical fitness.

Wives of officers provided somewhat more moderate evaluations of these factors. Approximately 30 percent or more of each group indicated favorable change had occurred on five of the six factors. Worry about non-health related matters was viewed as having favorably changed by only a few of the wives.

Almost all officers and wives are in favor of continuation of this or a similar physical fitness training program. Control group officers were in favor of continuation provided they could participate actively. Wives indicated they would like to participate in such a fitness training program themselves.

Both officers and wives further responded that the program was well worth the time required, and overall they were pleased or very pleased with their experiences with the program. Increased interest in and/or concern for physical fitness in relation to self and family members was also reported by the great majority of both groups of respondents. Nearly all respondents believed that institution of such a fitness training program would be beneficial for all police officers.

Feedback information provided by the Institute for Aerobics Research to officers' wives was viewed as "complete and understandable" and "helpful in understanding the program" by both officers and wives. Wives more frequently indicated that this feedback was cause for "some peace of mind" than did officers.

Generally favorable ratings were provided for amount of orientation, quality of instruction, and results, in addition to feedback information. No clear differential trends are apparent among the responses for officers and wives, with the exception that officers tended to rate quality of instruction higher than did the wives. Since officers were directly involved in the program, it is expected that their ratings reflect more specific opinions of the administration of the program.

These results are important for several reasons. Feelings of increased physical and mental fitness parallel the actual physiological improvements discussed in Chapter 5. Thus, officers are more fit and feel more fit. Perceived psychological improvement is as important an incentive to participation in a fitness training program as actual physical improvement. The increased job satisfaction noted among younger officers may also be an important incentive for participation in voluntary fitness programs. Increased self-confidence and ability to relax and decreased tenseness are widely thought to be correlates of increased physical fitness; the results reported in this study tend to confirm this belief.

While self-perceptions of increased physical fitness are of primary importance, perceptions of what have been termed "significant others" are of at least secondary importance. In this study, the significant other consisted of the participating officer's wife. Appreciation of increased physical and mental condition by the officer's spouse could be a powerful incentive for continued participation in fitness programs.

Equally important are the results from both officers and wives concerning the fitness training programs themselves. Both groups of respondents overwhelmingly indicated desire for continued participation. Officers in control groups and wives across all groups indicated a desire to participate themselves in such a fitness training program. Nearly all officers and wives in all five groups felt that this or a similar physical fitness training program would be beneficial for all police officers and further indicated that participation had increased their interest in fitness in relation to themselves, as well as other members of their families. The benefits of participation in a physical fitness training program, then, are viewed as having applicability not only to oneself, but also to families and to the larger enforcement community.

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CHAPTER 7

RESULTS OF THE NATIONAL SURVEYS

In an attempt to obtain a national perspective on the number of police departments having physical fitness programs for their sworn officers and what types are most common, a questionnaire was mailed to a stratified, random probability sample of 655 departments across the country.

A stratified sample was warranted because there are several different types of police departments, logically falling into five groups or strata. The first three strata represent municipal departments from cities of various sizes: (1) cities with populations of 100,000 or more; (2) cities with populations between 25,000 and 99,999; and (3) cities with populations between 2,500 and 24,999. The fourth stratum includes all state-wide law enforcement agencies and the fifth stratum includes county police agencies.

Of the 655 departments which received the questionnaire, 302 responded for an overall rate of 46 percent, see table 7.1.

Screening Questions

To facilitate responses to the survey instrument, a series of screening questions were devised. These questions concerned primarily the presence or absence of a variety of fitness-related programs or policies.

Respondents were asked to respond yes or no to these questions. If the response was yes, we asked that they answer a series of specific questions dealing with the subject of the screening questions. The screening questions were as follows:

Table 7.1 Response Rate of Agencies Within Each of the Five Strata

Stratum	Questionnaires Forwarded	Questionnaires Returned	
	Number	Number	Percent
I. Cities over 100,000	153	98	64.1
II. Cities between 25,000 and 99,999	146	73	50.0
III. Cities between 2,500 and 24,999	162	62	38.3
IV. States	49	41	83.7
V. Counties	145	28	19.3
Total	655	302	46.1

1. Does your police agency currently have an established physical fitness training program for sworn police personnel?
2. During the past ten years, has your police agency had a physical fitness training program for sworn police personnel which was later discontinued for any reason?
3. Does your police agency provide any organized team or racket sports activities for sworn police personnel?
4. Does your police agency receive any special group rates for the use of local "outside" facilities such as the YMCA/YWCA, health clubs, community sports facilities, etc.?
5. During the past ten years, has your police agency requested funding from any source for a physical fitness program or for physical fitness training equipment?
6. Does your police agency currently have any kind of weight maintenance program, policy, or regulation for sworn police personnel?
7. Other than on return to duty following illness or injury, are sworn police personnel in your agency required to have medical examinations during their careers? (For example, on an annual basis, at the time of promotion, periodically, etc.)
8. Are sworn police personnel in your agency required to take physical performance tests (i.e., test of agility, strength, endurance, etc.) during their careers? (For example, on an annual basis, at the time of promotion, periodically, etc.)

9. Does your police agency require a physical performance test (i.e., agility, strength, endurance, etc.) for applicants to the position of sworn police officer (i.e., at the entrance level or selection stage)?

Improving the physical fitness of sworn officers is a very low priority. Only 43 of the 302 responding agencies reported existing physical fitness programs. Ten percent of the departments indicated they employ a weight maintenance program, and 20 percent provide team or racket sports.

Development

The most frequently indicated reasons for implementing a physical fitness training program were "administrative decision to improve overall physical fitness," and desire to improve overall job performance." More specific conditions within the department, including obese appearance, evidence of stress, and high injury rate, were cited with less frequency. The number of heart attacks is fairly low on the list, while "lack of fitness relative to citizens" is surprisingly high.

Apparently these programs have been implemented primarily through the use of top administrative-level decisions based more on appearance and "general feelings" than on specific studies of conditions within the department. Outside impetus from either local civil service commissions or local governments has not been a factor.

Administration

Items included under the general heading "administration" primarily concern the way in which these programs are conducted and the requirements which are associated with them.

The majority of physical fitness training programs are voluntary rather than mandatory and exemptions are generally allowed for medical reasons. Regardless of whether programs are voluntary or mandatory, less than half of them require officers to satisfactorily complete a medical exam before participating.

Instruction in the program content and the use of equipment is usually provided for participants. These Instructors most often are academy or other police training personnel. Several agencies indicated that orientation and instruction are provided merely through the posting of the departmental policy statement and specific written guidelines for equipment use. Due to the voluntary nature of the majority of these programs, very few require officers to participate a minimum number of hours per week. Records of participation are generally maintained, however, the most frequently used mechanisms are simple sign-in, sign-out procedures.

Physical Fitness Program Content

The majority of programs consist of running/jogging, weightlifting, and calisthenics, although self-defense skills and organized sports are also mentioned with some frequency. It is apparent that many departments offer several types of activities to their program participants.

The equipment available to participants does not differ to as great an extent as content emphasis, perhaps because programs involving running or calisthenics do not require special equipment. While a variety of equipment may be utilized, most of the equipment focuses on weight and strength training. State agency programs, which more frequently involve calisthenics, tend not to use any special equipment.

Evaluation

When asked if the physical fitness training program had ever been formally evaluated for effectiveness or job relatedness, only one of the 43 responding agencies indicated "yes." All other departments reported that no formal evaluations have been conducted on these programs. Under these conditions, it is difficult to assess the overall value of these programs.

Some indications of effectiveness, however, can be obtained by examination of the types of problems which these agencies have faced in relation to their physical fitness training programs.

Less than half of the responding agencies indicated that problems have resulted from the implementation of physical fitness training programs. The single most frequently reported problem was "lack of interest or participation in this program by sworn personnel." Additional problems reported involved inadequate funding, inadequate facilities, and increased absenteeism due to injuries suffered as a result of participation in the programs.

Weight Maintenance Programs

Weight maintenance programs for sworn personnel were reported by 60 of the 302 responding agencies. The greatest aid in the development of weight maintenance programs came from medical examiners or doctors and police academy or training personnel. In contrast to the physical fitness training programs, the majority of weight maintenance programs are mandatory, and few exemptions are allowed.

Periodic Medical Examinations

Over one-third of the 302 responding agencies require medical examinations at some time during an officer's career other than on return to duty following illness or injury. Although over 40 percent of the large and medium-sized city departments indicated the use of annual medical exams, the majority of responses indicated medical exams are required at the time of promotion only.

Seventy-five percent or more of the agencies indicated that the periodic medical exams include tests of vision. Relatively few of these exams, however, utilize standards which have been based on either age or job analysis. Thus, all officers within a department presumably obtain the same type of medical exam, without regard to the officer's age or job activities.

Periodic Physical Performance Examinations

Only 16 of the 302 responding agencies provide for periodic tests of the physical performance of their sworn personnel. The majority of these testing programs are mandatory, and over half grant exemptions. Most departments utiltze standards that differ according to the age of the officer, however, no agency has based the standards on job/task analyses. Typically, these tests are conducted by academy/training personnel or a combination of academy personnel and departmental physicians. Most such tests are given every six months, every year, or upon promotion.

Sports Programs

A total of 73 agencies indicated that they provide some form of organized team or individual sports programs for sworn personnel. Types of sports activities are quite varied. It is not surprising that larger agencies tend to be more diversified in the programs offered, nor are the most "popular" sports indicated (i.e., baseball, basketball, bowling, and football) unusual. Other sports offered include racketball, golf, volleyball, ping-pong, wrestling, and weightlifting.

Facilities for these programs are also varied, although most programs utilize areas or rooms of departmental or academy buildings for at least some sports activities. The other responses consisted primarily of city and county parks and other recreational areas.

Special Group Rates

Only 45 of 302 agencies reported receiving any special group rates at local, commercial facilities outside the police agency. The most frequently mentioned facilities were those of the local YMCA's.

Funding

Responses to the screening question concerning requests for funding revealed that the majority of agencies have not requested financial support for physical fitness related programs or equipment over the past ten years. A single follow-up question sought to determine the reasons for not having requested financial assistance. Fairly even distribution among the possible response categories was found. "Low on the list of priorities," and "lack of interest" seem to be the most frequently indicated reasons, but "local government would never approve the request" was also cited by substantial percentages of agencies.

Other responses to this question were equally varies. Some of these reasons included the following:

- "It's already included in the corporate budget."
- "Problem has just recently surfaced."

- "Will be included in next year's budget."
- "Don't have enough officers to take any off the street for such a program."
- "Department is too small to justify such a request."
- "Geographic dispersion across entire state would make such a program difficult to administer."
- "Didn't know funding was available for such programs."

All of these responses suggest rather clearly that there is no single reason or problem which discourages agencies from requesting financial assistance for physical fitness related programs and equipment. Some problems are local (e.g., "government would never approve"), while others are specific to certain types of agencies (e.g., "since personnel are scattered across state, the administration of a program would be very difficult"). It would seem, however, that the two most frequently mentioned reasons (i.e., "low on the list of priorities" and "lack of interest") are interrelated internal departmental problems which could be dealt with at the command or administrative level. It is difficult to assess what the effects of a concerted departmental effort to establish a program with outside funding might be on the funding sources themselves.

Additional follow-up questions were asked of those agencies which have requested financial assistance for physical fitness related programs and equipment over the past ten years. The majority of these requests were made to local government or the Law Enforcement Assistance Administration. Local businesses and community organizations have been approached by a few city agencies, but no state police agency has requested funding from the State Planning Association.

The substance of the overwhelming majority of these requests for financial assistance consisted of universal gym sets and other weight training equipment. Less frequently mentioned equipment included rowing machines, exercycles, mats, jump ropes, softball and basketball equipment, and uniforms. Less than five agencies indicated that funding was requested for program development or implementation.

Entrance-Level Physical Performance Tests

A total of 178 of the 302 responding agencies require physical performance (i.e., agility, strength, endurance, etc.) tests at the entrance or selection stage.

The great majority of agencies use the results of these tests as qualifying standards only, i.e., applicants either pass or fail. Entrance level physical performance tests are identical for male and female applicants in the majority of agencies. Where differences exist a variety of explanations between tests for men and women are provided; the most common ones included the following:

- women are not required to take physical agility tests
- women do modified, fewer pushups, pullups, and/or chin-ups
- wall climb tests involve walls of different heights
- timed course allows longer time for women.

Twenty-eight of the agencies reported that their entrance-level physical performance tests have been validated. Since little specific validation information was received, the quality of these studies and/or their results cannot be determined.

Loss of Personnel

Many of the responding agencies were able to provide a variety of statistical information on those personnel who left the department during the previous twelve months. Of particular interest in relation to physical fitness are statistics from 290 agencies concerning the number of officers who died, retired early, or were placed on limited duty (for medical/health reasons) during this twelve-month period.

Five thousand five hundred forty-four vacancies were created in 1975 within the 209 agencies responding to this question. Eighty percent of this attrition resulted from scheduled retirements and resignations, 6 percent were caused by deaths and 14 percent were the result of early retirements. The majority of deaths occurred off-duty, however, of the on-duty deaths reported, 21 percent were caused by medical/health reasons. Medical/health reasons were cited as the cause of 60 percent of the deaths occurring off-duty.

Medical/health deaths in the line of duty involve officers of all ages rather than any particular age group. Deaths in this category which occurred off-duty generally involved officers over the age of 40.

Turning to the subject of early retirement, Table 7.2 presents data indicative of the variety of causes of loss of personnel prior to reaching retirement age or length of service. Some agencies were unable to provide specific reasons for all of their early retiring officers. Other agencies indicated that the information requested on early retirees was not available. Nevertheless, for comparative purposes, percentages have been based upon the available data.

Table 7.2 Number and Percent of Officers Who Retired Early for a Variety of Reasons

	100,000+		25,000 to 99,999		2,500 to 24,999		State Agencies		County Agencies	
	I		II		III		IV		V	
	N	%	N	%	N	%	N	%	N	%
Back Trouble	90	22.6	4	16.0	0	-	20	22.7	0	-
Permanent Injury In Line of Duty	88	22.1	6	24.0	1	25.0	18	20.4	0	-
Heart Attack	70	17.6	2	8.0	2	50.0	13	14.8	2	33.3
Psychological/Psychiatric Reasons	35	8.8	3	12.0	1	25.0	7	8.0	1	16.7
High Blood Pressure	23	5.8	1	4.0	0	-	4	4.5	0	-
Terminal Disease	12	3.0	0	-	0	-	4	4.5	2	33.3
Permanent Injury Off-Duty	14	3.5	1	4.0	0	-	0	-	0	-
Circulatory Disease	11	2.8	1	4.0	0	-	2	2.3	0	-
Arthritis	6	1.5	1	4.0	0	-	5	5.7	0	-
Lung Disease	8	2.0	1	4.0	0	-	2	2.3	0	-
Stroke	2	0.5	0	-	0	-	1	1.1	0	-
Diabetes	1	0.2	0	-	0	-	1	1.1	1	16.7
Peptic Ulcer	1	0.2	1	4.0	0	-	0	-	0	-
Liver Disease	0	-	0	-	0	-	1	1.1	0	-
Other	37	9.3	4	16.0	0	-	10	11.4	0	-
Total	398	99.9	25	100	4	100	88	99.9	6	100

It is apparent that back trouble, permanent injury suffered in line of duty, and heart attacks were responsible for nearly half of the early retirements. Back trouble alone accounted for 23 percent of the early retirees in Strata I and IV and 16 percent of those in Stratum II. Permanent injury suffered in line of duty caused between 20 percent and 25 percent of early retirements in city agencies of all sizes and in state agencies. Early retirement resulting from heart attacks ranged from 8 percent in Stratum II to 50 percent in Stratum III.

Limited Duty

The largest single cause of limited duty assignments consisted primarily of temporary injuries suffered both on- and off-duty. However, of the specific conditions listed in Table 7.3, it is immediately apparent that the three most frequently mentioned causes of limited duty assignment are also the three most frequently mentioned causes of early retirment, i.e., back trouble, heart attacks, and permanent injury suffered in line of duty. High blood pressure and circulatory disease account for substantial numbers of limited duty assignments.

Summary

It is useful to examine data on loss of personnel for a variety of reasons directly related to the purposes of this study. It is equally helpful to summarize these data.

Off-duty deaths exceeded deaths in line of duty in all reporting agencies. For these off-duty deaths, medical/health conditions were the cause of more deaths than were accidental occurrences. In fact, medical/health caused deaths off-duty far exceeded accidental deaths in line of duty

Table 7.3 Number and Percent of Officers Who Were Placed on Limited Duty for a Variety of Reasons

	I		II		III		IV		V	
	N	%	N	%	N	%	N	%	N	%
Back Trouble	301	33.2	13	17.8	1	11.1	31	36.5	0	-
Heart Attack	107	11.8	5	6.8	0	-	5	5.9	1	33.3
Permanent Injury In Line of Duty	106	11.7	6	8.2	1	11.1	4	4.7	0	-
High Blood Pressure	51	5.6	3	4.1	0	-	7	8.2	0	-
Circulatory Disease	47	5.2	3	4.1	1	11.1	0	-	0	-
Permanent Injury Off Duty	37	4.1	2	2.7	0	-	1	1.2	0	-
Psychological/Psychiatric Reasons	34	3.8	2	2.7	0	-	0	-	1	33.3
Peptic Ulcer	29	3.2	1	1.4	0	-	2	2.4	0	-
Arthritis	18	2.0	0	-	1	11.1	0	-	0	-
Terminal Disease	13	1.4	0	-	0	-	1	1.2	0	-
Stroke	6	0.7	1	1.4	0	-	3	3.5	0	-
Lung Disease	9	1.0	0	-	0	-	0	-	0	-
Liver Disease	5	0.6	0	-	0	-	0	-	0	-
Diabetes	3	0.3	0	-	0	-	0	-	0	-
Other	139	15.4	37	50.7	5	55.6	31	36.5	1	33.3
Total	905	100	73	99.9	9	100	85	100.1	3	99.9

in terms of raw numbers. For all deaths which occurred in the previous twelve months, both in line of duty and off-duty, officers in all age groups were victims, although among off-duty deaths, officers 41 years of age and older were victims more often than younger officers.

These statements indicate the prevalence of medical/health conditions as the causes of death of police officers in the agencies surveyed. No specific information was obtained on the exact medical/health conditions involved here, but it is clear that accidental occurrences are less frequent than medical/health caused deaths. In addition, medical/health conditions may affect police officers of any age, just as, of course, may accidents. Medical/health caused deaths are not a concern for only older officers.

At the same time, medical/health conditions cause the majority of the progressively less severe results of early retirement and limited duty assignment. Striking similarities in the reasons cited for these two occurrences were found particularly in the three reasons mentioned most frequently, i.e., back trouble, permanent injury in line of duty, and heart attack. Although injuries suffered in line of duty are most probably unpredictable occurrences, back trouble and heart attacks oftentimes are both predictable and preventable. Certainly, back trouble can be predicted in any occupation requiring large percentages of the incumbent's time spent in driving automobiles; and heart attacks have been shown to be directly related to amount of job stress.

Information concerning the ages of officers who retired early or were placed on limited duty indicated that both results may affect officers of any age. The majority of early retirees were over the age of 40, but retirement in the early 40's represents a loss of perhaps ten to fifteen years at least of active service on the police force. Limited duty assignments seemed to have been more evenly distributed across age groups than were early retirements.

Some further interesting statistics may be gained from combining the available data on heart-related conditions, i.e., heart attack, high blood pressure, circulatory disease, and stroke. Heart-related conditions were the single greatest cause of early retirement and the second greatest cause of limited duty assignments among the agencies responding to this survey. Heart-related conditions may also cause both early retirement and limited duty assignments among officers of any age.

These data suggest the seriousness of medical/health conditions in general and heart-related conditions in particular in terms of the numbers of officers who die or are retired early or are placed on limited duty assignment among the agencies responding to this survey.

Police Officer Survey

In order to assess the attitudes of police officers toward physical fitness and to learn how the average police officer assessed his state of physical fitness, a questionnaire was mailed to a stratified, random probability sample of 3,814 sworn police officers from the 302 departments responding to the departmental survey. A total of 1,904 officers completed and returned the questionnaire.

The average responding officer was a white male, 35 years and 7 months old, six feet tall, 189 pounds, married, Protestant, and had more than a high school education. He was more likely to be a patrolman, assigned to patrol function, and had a better than average chance to be working permanent hours. If he worked a rotating shift, he was most likely to rotate every month or every four weeks.

Perception of Health

We attempted to determine if the majority of police officers responding to the survey questionnaire had similarity of experience, or attitudes, or habits in various areas concerning health, attitude toward physical fitness, and perception of ability to perform their duties adequately.

Rest

One factor which is frequently attributed to poor physical conditioning is lack of energy, sluggishness, or tiredness. We asked each respondent to indicate how he generally feels upon waking up. Four choices were available:

(1) Completely Rested
(2) Somewhat Rested
(3) Somewhat Tired
(4) Very Drowsy

The vast majority of officers indicated they were completely or somewhat rested when they woke up. We may conclude, therefore, that proper rest is not a problem among our respondents. This pattern is also consistent with the experimental studies conducted by IAR where the vast majority of officers reported they obtained 7 to 8 hours of sleep per day.

Back Problems

Among the many illnesses and ailments often attributed to the sedentary nature of police work, coupled with shift rotation and job-related stress, is chronic back problems. Therefore, we endeavored to discover the number of police officers who encounter this problem. Although the majority of responses indicated that lower back pain was never or only rarely a problem, a number of persons did report that back problems were more likely to be encountered while driving an automobile than in any of the other given situations. Since a large period of the police officer's working day is likely to be behind the wheel of an automobile, this is quite interesting. Many lower back problems are attributed to lack of proper exercise of lower back muscles. Poor posture caused by overweight also contributes to lower back discomfort. Earlier we stated that back problems cause the most limited duty assignments and are the cause for the majority of early retirements. It is probable to presume, therefore, that a good physical fitness program could attribute to decreasing sick time, limited duty assignments, and early retirements in those cases where lower back problems are the cause for incapacitation.

Weight

The majority of those responding to the questionnaire preceived themselves as overweight from 1 to 20 pounds. Officers who felt they were underweight were few in number, and less than one-third of all officers believed their body weight was proper.

Sick Time

The number of days off for illness during the calendar year 1975 was reported by each officer completing the survey. Table 7.4 shows the average, mean, and range of the number of sick days reported during this calendar year. The average and mean are, of course, affected by the range.

In Stratum II, for example, two persons reported they were absent from work during the entire year. However, when one multiplies the average by the number of officers responding to this question, a total of 10,616 days were lost by only 1,880 officers during 1975. This is a total of 29.9 man-years.

Perceptions of Stress

Research over the past several years has implicated psychological stress as an important causal factor in coronary heart disease, gastro-intestinal malfunction, dermatological problems, severe nervous conditions, neurosis and various other physical and mental disorders. In comparison to workers in other occupations, police officers seem to have unusually high rates of many apparently stress-related illnesses. Our survey questionnaire asked the respondents to reply to many of the areas of concern attributed to psychological stress among police officers.

Marital difficulties, problems with neighbors, raising a family, alcohol, and in at least one reported case, overeating; job stress has been named as the causative factor. We asked each of the officers to respond to the question, "Of the five police officers in your agency with whom you work most closely, how many have had serious problems with the following?" Frequency of alcohol problems; the majority of respondents indicated that none of their five closest associates had difficulties with alcohol. This series of questions also had the greatest number of No Response, which may be indicative of the fact that police officers do not like to respond to questions of this nature. However, 33 percent of the officers acknowledged at least one of their closest police associates had problems with alcohol.

Those who knew of marital problems was even greater. Very few of the respondents had no knowledge of marital problems within their five closest associates. Here again, the number of officers who did not respond was greater than appeared in questions concerning personal medical history.

Financial problems, on the other hand, are quite prevalent among the associates of the officers completing the survey. Almost 60 percent of all officers have known of at least one officer who has encountered financial problems. Although financial difficulty is certainly a problem leading to stress, it is not uncommon for persons in any occupation to know of at least one colleague who has faced money difficulties. It would be most unusual if the opposite was the case.

Reported drug problems of police officers are almost nonexistent according to our responses. Only 41 of the 1,904 officers who completed the survey knew officers who had serious drug problems.

Suicide or suicide attempts is often the route taken by those overburdened with stress and frustration. In an effort to determine if suicide plays a significant role in the life of police officers, we asked the number of officers known by our responderts who have attempted or successfully committed suicide. Although 1,271 of the respondents knew no one who had attempted this act, 633 officer had knowledge of 1,093 occurrences.

The question now becomes one of conjecture and opinion. However, we asked each respondent if they felt that the incidents of suicide were precipitated by the effects of the police job. The majority of those who responded to the question felt that police employment did play a role in the police officer suicides. At least 50 percent of the officers believed the police job definitely or probably contributed to the suicide attempts.

The reader must keep in mind, however, that in a study of this kind many responses are from officers employed in the same police agency. Therefore, it is reasonable to assume that in an agency which had ten officers respond that know of three incidents each, the total suicides or attempts in that agency may only be three if each officer knew the same victims. This also is true of those cases of marital, family, alcohol, and neighborhood difficulties. We will not attempt to draw any conclusions based on these data concerning stress, but report it only as a factor that is prevalent in the police community.

Perception of State of Personal Health

The officer's perception of his own state of health is quite revealing. As has been shown in the study conducted in Dallas, Texas, by the Institute for Aerobic Research, police officers tested who were between 20-29 years of age were average in all coronary risk variables except body fat in comparison with general population groups. However, officers 30-31 years of age scored significantly lower in cardiorespiratory endurance and other coronary risk variables. Overall, younger police officers were found to be of average risk, and older officers were in higher risk categories.

The officers who responded to this survey questionnaire generally perceive themselves as healthy. Sixty percent of the officers rate their health as better than the average officer their own age; 71 percent or more of the officers responding were at least moderately concerned about their general health. Fifty-eight percent or more of the officers believe an individual can control his general state of health. A majority of officers in each group also believe there is a likelihood that a person in his age group could suffer from a heart attack; however, more than half of the respondents reported that it was unlikely that they themselves would suffer a heart attack within the next ten years. To a certain degree, this may indicate that the respondents are burying their heads in the sand. Not unlike those persons who, although they are aware of the effects of smoking, continue to use cigarettes or other smoking materials, they have adopted the attitude that, "It can't happen to me." When asked to respond to the question, "Do you think you get enough exercise?", less than one-half of the officers reported "yes."

The responses also indicate a perception about the entrance-level medical standards. If 50 percent of the officers feel that they do not exercise enough to maintain good physical condition, one might be led to believe that they would have difficulty passing an entrance-level medical and physical fitness exam for police service.

However, with the exception of officers employed by state agencies, over 50 percent of the responses indicate that present medical standards are easy, and only 10 to 15 percent of the officers doubt their ability to pass these exams at the present time.

Perceptions of Physical Performance and Job Requirements

Officers completing the survey questionnaire were asked to respond to a series of questions concerning the frequency of performance in certain job-related activities. The vast majority of officers are rarely required to perform these activities, i.e., chasing a suspect on foot, climbing a a fence in pursuit of a suspect, running up a flight of stairs, pushing a stalled car by hand, lifting a sick or injured person, struggling with a resisting suspect, separating two or more fighters, climbing a ladder, or lifting a heavy object.

These activities are often among those that police applicants are required to perform in specified periods of time to demonstrate their physical ability. In general, police officers completing the survey seem to have a great deal of confidence in their ability to perform the physical requirements of their job. Officers rated their speed, endurance, agility, strength, and combat skills as average or better. They are inclined to believe that entrance level physical standards are more likely to be easy than difficult and have confidence that they could pass the entry-level physical requirements of their department. More than 50 percent of the officers rate their physical condition higher than that of the officers with whom they work. The respondents also felt that police work was more physically and emotionally dangerous than other public safety occupations.

These perceptions of the respondents toward their physical ability and their fellow officers' capabilities are probably overrated.

The officers involved in the physical fitness program conducted by Aerobics Research reported similar perceptions of themselves and their fellow officers prior to completing the initial physical ability tests and engaging in a conditioning program. These attitudes changed, however, once the officers were tested and their actual capabilities were known. Based upon the infrequency the majority of officers are required to demonstrate their physical abilities even to themselves, they are likely to believe that they can perform satisfactorily. The number of police agencies which require officers to demonstrate physical skills on a regular basis are rare. Therefore, their point of reference is possibly the last time they were required to exert themselves which may have been in the distant past. If entrance-level fitness requirements were required when they entered police work, and they have been employed for five years, their point of reference may be the condition and ability demonstrated at that time. Periodic physical testing would provided the officer with a proper assessment and become an incentive to maintain proper physical conditioning.

The question, "Do you believe that your police agency should provide a physical fitness program for sworn police personnel?", received an overwhelming, affirmative response. Ninety percent of the respondents were in favor of department-sponsored physical fitness programs. Less than 10 percent of the respondents replied that departments should not provide physical fitness programs. These officers indicated: (1) it was the individual's responsibility to maintain proper physical condition, (2) participation would interfere with the officers' off-duty responsibilities and, (3) they currently engaged in a personal fitness program to their own likeness and did not desire departmental interference.

In general, the officers appeared to be serious about the prospect of a physical fitness program. Over 90 percent of the officers indicated they would participate if their department provided such a program. In addition, 73 percent or more of the officers thought that participation in physical fitness training should be mandatory.

The officers were then asked to respond "yes" or "no" to several statements which would most likely stimulate interest in physical fitness programs for police officers. Orientation and information, publication of the medical/physical condition of police officers, and participation by first-line supervisors and administrators all received majority responses. However, over 85 percent of the respondents indicated that officer involvement in program development would be most likely to stimulate interest.

As might be expected, compensatory time off and additional salary were listed as incentives which would encourage officer participation in physical fitness programs. Salary increases and extra points on promotional exams, were listed as incentives by about half of the respondents. Formal recognition and preference in special assignments received less response.

One of the most frequent questions asked by department administrators considering the implementation of a physical fitness program is what type of disciplinary action should be taken against those officers who refuse to participate in physical fitness programs. We asked the officers responding to the survey to indicate "yes" or "no" to several administrative actions common to police discipline. Among these were: loss of annual leave days, monetary fine, suspension; dismissal, reassignment, transfer, ineligibility for promotion, verbal reprimand; letter in personnel file, individual counseling to develop a remedial program, and no administrative action should be taken. While approximately 25 percent of the officers indicated that no action should be taken, there was no mandate for any of the given disciplinary actions. However, individual counseling to develop a remedial program was preferred by more than half of the respondents.

Officers indicated that participation in a physical fitness program should be more than once per week, but less than daily, and for sesions of approximately 60 minutes.

The activities which the officers preferred were quite varied: jogging/running, calisthenics or slimnastics, and self-defense were listed most often by the majority of officers, although almost any traditional physical fitness program activity would have support. The majority of officers also indicated that calisthenics and running/jogging were best for creating and maintaining good physical condition.

The majority of the respondents reported that personal benefits gained by participation in fitness programs are: greater overall fitness for the individual and his fellow officers, increased feelings of well-being, and greater confidence in one's partner and other officers. Additional benefits indicated by at least 75 percent of respondents are: decreased number of heart attacks, decrease in injury rate and sick time, and decreased feelings of tension with the increased ability to relax.

The problems perceived most often by the officers in the establishment of a physical fitness program were obtaining the interest and motivating the police officers. Surprisingly, establishing rewards for participation and penalties for nonparticipation were not seen as major obstacles by 50 percent of the officers responding. Sixty-nine percent or more of the officers favor periodic requalification of physical fitness testing, and the majority indicate that requalification should be conducted every 12 months. Periodic requalification on proportional weight to height standards was also favored by the majority of the officers.

Site Visits

During the planning stages of this project, it was determined that considerable information and insight could be gained by visiting departments which were conducting physical fitness programs. The main objective would be to glean information from these departments which would be beneficial to police administrators to avoid problem areas and to learn of successful programmatic experiences.

The secondary goal was to learn of negative experiences in physical fitness programs in those departments which had implemented programs but had discontinued these activities.

The selection of the agencies which would be visited was largely determined by the return of the national police department survey. As returns were received, it was carefully noted which agencies had (1) a physical fitness training program, (2) discontinued a physical fitness training program, (3) conducted a mandatory weight maintenance program, or (4) required all sworn personnel to qualify in a physical agility examination.

As was reported earlier, very few of the responding departments indicated they had an established physical fitness training program for sworn police personnel. Even fewer departments indicated they had a physical fitness program during the last ten years which was discontinued for any reason. Because of the limited number of departments which had experience in physical fitness programs, it was determined that size of agency, geographic location, and type of experience would all be factors in selecting agencies for site visits.

What we discovered was that in many cases, departments reporting they conducted physical fitness programs in fact held only periodical physical agility testing, weight maintenance checks, or had mandatory physical fitness programs only during recruit training. Many departments had voluntary fitness programs, but none actually had a program which required periodic exercise on a regular basis. Tables 7.4 and 7.5 lists those departments which indicated in the national survey that they conducted physical training, agility testing or weight maintenance programs.

The visits to specific departments revealed that while physical fitness is a part of the administrative policy in many agencies, only a few departments have actually made fitness evaluation and maintenance a priority. Although several agencies require annual or periodic medical testing, only two of the agencies visited require testing of agility and endurance. The major reasons these programs are not implemented is lack of funds and lack of operational expertise.

The majority of departments are greatly concerned with physical agility performance for entry level personnel, and many are devoting time and personnel in this area.

Police agencies continue to recruit physically capable personnel. Their training programs are likely to include regular physical conditioning. However, once transferred to a regular assignment, the majority of departments do not require officers to remain physically fit.

The most important finding that resulted from our site visits is that in those agencies with physical fitness programs that are enjoying some success,

Table 7.4 AGENCIES REPORTING CURRENT PHYSICAL FITNESS PROGRAMS

Physical Fitness Training Programs

- Alaska Department of Public Safety
- Albany, Georgia
- Arvada, Colorado
- Athens, Ohio
- Beaumont, Texas
- Bloomington, Indiana
- Canton, Ohio
- Cedar Rapids, Iowa
- Charlotte, North Carolina
- Chicago, Illinois
- Cincinnati, Ohio
- Colorado Springs, Colorado
- Corydon, Indiana
- Dallas, Texas
- Danvers, Massachusetts
- Georgia Department of Public Safety
- Gilroy, California
- Glendale, California
- Greensboro, North Carolina
- Hialeah, Florida
- Jackson, Mississippi
- Jersey City, New Jersey
- Kansas City, Missouri
- Lakewood, Ohio
- Los Angeles, California
- Memphis, Tennessee
- Missoula, Montana
- New Orleans, Louisiana
- Newport Beach, California
- North Carolina Highway Patrol
- North Dakota Highway Patrol
- Oak Park, Illinois
- Oakland, California
- Omaha, Nebraska
- Orange, California
- Pennsylvania State Police
- Rhode Island State Police
- Richardson, Texas
- San Francisco, California
- Shreveport, Louisiana
- Springfield, Illinois
- Toledo, Ohio
- Woodland, California

Table 7.5 DEPARTMENTS REPORTING WEIGHT MAINTENANCE PROGRAMS

Alaska Department of Public Safety
Aldan, Pennsylvania
Arizona Department of Public Safety
Arlington, Texas
Bangor, Maine
Bell Garden, California
Bloomington, Indiana
California State Police
Cedar Rapids, Iowa
Chesapeake, Virginia
Cincinnati, Ohio
Corydon, Indiana
Delaware State Police
District of Columbia
Fresno, California
Georgia Department of Public Safety
Gilroy, California
Gladstone, Missouri
Hialeah, Florida
Honolulu, Hawaii
Independence, Missouri
Kansas City, Missouri
Kansas Highway Patrol
Lakewood, Colorado
Las Vegas, Nevada
Live Oak, Texas
Lombard, Illinois
Los Angeles, California
Louisiana State Police
Maryland State Police
Miami, Florida
Minnesota State Patrol
Missouri State Highway Patrol
Montgomery, Alabama
Nevada Highway Patrol
New York State Police
North Carolina Highway Patrol
North Dakota Highway Patrol
North Haledon, New Jersey
North Las Vegas, Nevada
Oak Park, Illinois
Ohio Highway Patrol
Omaha, Nebraska
Orange, California
Oregon State Police
Ouachita Parish, Louisiana
Pennsylvania State Police
Philadelphia, Pennsylvania
Rhode Island State Police
San Diego, California
San Francisco, California
St. Louis, Missouri
Tucson, Arizona
Virginia Beach, Virginia
Virginia State Police
Washington State Police
Wilmette, Illinois
Wisconsin State Police
Wyoming State Highway Patro[illegible]

the chief administrator and his staff are actively engaged in the program. This involvement of the departments' leaders cannot be overemphasized. As with any program, the leadership displayed is responsible for the success or lack of support for the program. Of the departments visited, only four have programmatic experiences which warrant discussion. These programs are summarized in the following pages.

KANSAS CITY, MISSOURI

Physical Fitness Program

A physical fitness training program was initiated in November 1974 as a result of an administrative decision to improve the overall physical fitness of police officers. The administrative analysis section and police academy personnel joined forces to explore various programs and approaches to the problem. The program selected as a year-round fitness program based on the book by Dr. Kenneth W. Cooper entitled, The New Aerobics. The program was implemented in three phases.

Phase I - Introduction

Officers were assigned to one in-service training day at the regional police academy where they were informed of the need for physical fitness, instroduced to the Aerobics System of exercise, and provided with reading and study material concerning fitness.

Phase II

Consisted of an EKG treadmill stress test conducted at a local medical facility. These tests are conducted for a fee of $25.00 each. All officers must pass the examination prior to participation in Phase III of the program.

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Phase III

A 12-minute run conducted at the regional police academy and at a local high school track. Performance is based on the distance ran. This test is conducted every six months and officers are eligible to receive from one to three additional days off during each six-month period. Officers who are rated in the poor or very poor category are required to attend supervised exercise sessions one hour each week, off-duty, until improvement is noted.

Program Results

All sworn personnel completed Phase I of the project by March 1975 and were encouraged to begin independent fitness programs.

As of January 1976, 493 officers had taken the EKG examination. Seven percent or 39 officers failed to pass the stress EKG and an additional 45 or 9 percent of the officers had been excused by the department physician because of medical problems. The 493 officers that have taken the test represents 40 percent of the law enforcement strength of the department.

As of January, 1976, 166 officers had concluded the first Aerobics Proficiency Test. Only 34 officers tested performed in the poor or very poor category. Eight percent of the officers tested earned from one to three days off.

Program Difficulties

The major difficulty encountered in this program has been the availability of funds to conduct the EKG treadmill stress test. Due to department budget limitations these tests were stopped in January 1976. They were resumed in July 1976 and the testing is continuing. Additional problems were encountered with scheduling officers to receive the tests. During 1975, 710 officers were scheduled to report for tests, however, only 493 tests were conducted. Scheduling problems were the result of court appearances, illness, and other individual difficulties.

Although this program has not progressed as rapidly as was anticipated, the administrative and operating personnel support the concept and believe it to be worthwhile. The decision to continue the program as designed indicates the department's satisfaction with the limited results. The discovery that 7 percent of those tested required medical treatment for heart related problems, two of which were cases requiring open heart surgery, are seen as most beneficial to administrative and line personnel.

Weight Maintenance Program

The weight maintenance program in Kansas City began in March 1974. Overweight was viewed by the department as a health and public image problem. The police physician and the police surgeon conducted investigations which resulted in the attached height/weight chart. Officers were scheduled for initial weight checks during the first two weeks of March 1974. At the initial weight check, any officer who was found to be overweight was assigned follow-up weight checks at four week intervals. At least a 10 percent reduction of the original excess weight was expected at each weight check.

Officers who, after three follow-up weight checks, were not achieving a satisfactory weight loss were referred to the department physician for diet counseling and complete medical examination.

If the physician ruled that there was no physical reason to hinder weight loss a letter was placed in the officer's personnel file. Those overweight

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Kansas City, Missouri Police Department

IDEAL WEIGHT SPAN

MALE

HEIGHT NO SHOES	AGE GROUPS	21-24	25-29	30-39	40-49	50-59	60-63
5'5"		137-158	143-166	149-173	153-177	154-178	151-169
5'6"		141-162	147-170	153-177	157-181	158-182	155-173
5'7"		145-166	151-174	157-181	161-185	162-186	159-177
5'8"		149-171	155-178	161-185	165-190	166-191	163-187
5'9"		153-176	159-183	165-190	169-194	170-196	168-193
5'10"		157-181	163-187	170-196	174-200	175-201	173-199
5'11"		161-185	167-193	174-200	178-205	180-207	178-205
6'0"		166-191	172-198	179-206	183-210	185-213	183-210
6'1"		170-196	177-204	183-210	187-215	189-217	188-216
6'2"		174-200	182-209	188-216	192-221	194-223	193-222
6'3"		178-205	186-214	193-222	197-227	199-229	198-228
6'4"		181-208	190-219	199-229	203-233	205-236	204-235
6'5"		214	224	235	239	242	241
6'6"		222	229	241	245	248	247
6'7"		228	234	247	251	254	253
6'8"		234	239	253	257	260	259
6'9"		240	244	259	263	266	265

IDEAL WEIGHT SPAN

FEMALE

HEIGHT NO SHOES	AGE GROUPS	21-24	25-29	30-39	40-49	50-59	60-63
5'2"		115-132	119-137	126-145	133-153	136-156	137-158
5'3"		118-136	122-140	129-148	136-156	140-161	141-162
5'4"		121-139	125-144	132-152	140-161	144-166	145-167
5'5"		125-144	129-148	135-155	143-164	148-170	149-171
5'6"		129-148	133-153	139-160	147-169	152-175	153-176
5'7"		132-152	136-156	142-163	151-174	156-179	157-181
5'8"		136-156	140-161	146-168	155-178	160-184	161-185
5'9"		140-161	144-166	150-173	159-183	164-189	165-190
5'10"		144-166	148-170	154-177	164-189	169-194	169-194
5'11"		149-171	153-176	159-183	169-194	174-200	173-198
6'0"		154-177	158-182	164-189	174-200	180-207	177-205
6'1"		158-181	162-186	168-193	178-204	184-210	184-211
6'2"		162-185	166-190	170-201	180-208	180-210	180-212
6'3"		164-189	170-194	174-205	185-213	185-214	184-213

officers who had not medical problems were required to weigh-in every four weeks until their goal weight was attained. At that time they were scheduled for weigh-in on an annual basis.

Results

This procedure was in effect until 1976. At that time, only 18 officers in the department had failed to comply with the weight requirements. A general order was issued establishing the weight maintenance program as a permanent program.

SAN FRANCISCO, CALIFORNIA

Physical Fitness Training Program

There is a voluntary program for officers interested in maintaining physical fitness. Most of the personnel participating in this voluntary program are members of the SFPD Police Olympic team. Facilities available for participants consist of the police gymnasium, the San Francisco State College track facility, and other appropriate places contacted by the individual officer. This latter group includes local high school tracks, swimming pools, gym facilities, and the like.

Any officer who wishes to participate in this voluntary program must first successfully complete a cursory examination adminstered by the academy physical fitness instructor. Blood pressure and heart rate are measured by means of a treadmill test. Those who fail this examination are directed to a physician and are not allowed to use departmental facilities for physical fitness exercise. Those who pass this exam and are "accepted" into the program may receive special counseling or instruction concerning exercise programs and/or equipment from the department physical fitness instructor. No other SFPD instructors are available.

The estimated number of regular participants is 135 officers each month, or somewhat less than 10 percent of the department. Most of these officers engage in sports activities related to the Police Olympics, e.g., wrestling, judo, softball, volleyvall, handball, swimming, and track and field. No records of participation are kept and the number of persons utilizing the facilities fluctuates almost daily. In an effort to increase participation, a variety of workshops, clinics, and seminars utilizing personnel outside the police department, including Weight Watchers, Alcoholics Anonymous, the Health Institute (Aerobics), anti-smoking groups, etc., have been conducted. These methods appear to draw additional participants for only a short period of time.

The police gymnasium, located in the headquarters building, is the only facility available for exercise workouts. The equipment includes one universal gym, a sauna bath, a whirlpool, one exercycle, several exercise mats, a set of free weights, and the necessities for volleyball and ping-pong. The universal gym was purchased with monies from the training fund, which is reimbursed from the city. The rest of the equipment is owned by the Police Athletic Club, an incorporated membership association which sponsors the SFPD Police Olympic team. Some of the exercise mats are owned by the Police Activities League, which is primarily responsible for sports programs for juveniles.

Department personnel indicated that two major problem areas surround this physical fitness program. The first of these is the voluntary nature of the program itself. Nearly every possible method of meetings, dialogues, cajoling, persuasion, and personal interest on the part of the department physical fitness instructor has resulted in less than 10 percent of the department participating. Even more frustrating is the large number of officers who show up for one week, or perhaps two, and then lose interest.

The second major problem area concerns insurance. Technically, the SFPD is liable for any injuring which occurs on the police premises including the gymnasium. In fact, three separate cases involving such gym injuries have gone to the retirement board this year. However, the SFPD has been unable to identify any insurance company willing to write a policy covering injuries suffered during voluntary sports activities.

Weight Maintenance Program

The SFPD conducts a mandatory weight maintenance program. The program was proposed by the academy physical fitness instructor. Although the idea was originally suggested in 1968, the program was not implemented for several years. This recommendation was not based on any specific study or evaluation; however, a combination of factors, including heart attacks, poor physical fitness performance, general obesity, and a lessening of standards for entrance requirements, created the need for weight maintenance standards. A supplementary decision to conduct regular physical fitness agility performance evaluations was made at the same time.

Specific standards for weight maintenance originally consisted of the Civil Service Commission height/weight requirements for selection, which were derived from the New York Life and Prudential Insurance Company.

When the program was implemented, an administrative decision was made to exempt all officers hired before March 16, 1970, from the weight maintenance requirements. At the present time, 580 officers, most of whom are assigned to patrol, are required to weigh-in twice a year.

Disciplinary actions are attached to this mandatory program. If an officer fails to meet the prescribed weight limit, he/she is given a three week "grace period" to lose enough weight to comply. If at the end of this time the officer is still overweight, he/she is ordered to report to the police surgeon. The surgeon must decide if the officer is in fact overweight or if his/her body frame permits the additional weight; he may also order any special medical treatment required, e.g., for hypertension, and/or a special exercise program. Progress reports are sent to the Director of Personnel.

If an officer still fails to meet the required weight standard, then disciplinary action can result in suspension, loss of days off, or dismissal. It is the administration's policy to favor required, supervised exercise workouts over suspension.

Approximately 3 percent of the 580 officers currently under this program fail to meet the semi-annual weight standard. Most of these, however, comply within the three-week grace period; disciplinary action is necessitated with less than 1 percent of the officers. No studies have been conducted on the effectiveness of this program.

Periodic Physical Performance Test

The SFPD decided to institute mandatory periodic physical performance tests in conjunction with the semi-annual mandatory weight maintenance program. The same exemptions are allowed, i.e., all officers hired bofre March 16, 1970, are exempt from program requirements.

The periodic physical performance test is administered twice a year at the same time as the weight maintenance program. The test itself is basically the same as the entrance examination administered by the Civil Service Commission during the selection process, although some modifications have been made. Tests and standards differ for male and female officers.

LYNCHBURG, VIRGINIA

The Lynchburg, Virginia, Police Department began a mandatory weight maintenance program and a voluntary physical fitness program in July 1975. This program was instituted as the result of an administrative decision to improve the overall fitness and appearance of sworn police personnel.

All officers are required to weigh-in two times each year and must be within the weight requirements for their height as indicated in the following chart. All officers failing to meet the standard weight are reuqired to lose 5 pounds per month. Their progress is checked at required monthly weigh-ins conducted by administrative personnel.

Any officer who fails to achieve a minimum weight reduction of 5 pounds per month is subject to the following disciplinary action:

First Occurrence - written reprimand
Second Occurrence - written reprimance and suspension for two days
Third Occurrence - written notice of prolonged suspension, demotion or dismissal.

Voluntary Physical Fitness Program

All officers who are not engaged in a personal physical fitness program are encouraged to meet with the administrative staff for assistance in establishing a voluntary personal fitness program. Upon request by the individual officer, administrative personnel will conduct a 12-minute walk-run

Lynchburg, Virginia

WEIGHT CHART (MAXIMUM)

MALE OFFICERS

HEIGHT	SMALL	MEDIUM	LARGE
5'1" or 61"	122	133	145
5'2" or 62"	134	146	153
5'3" or 63"	139	150	161
5'4" or 64"	144	156	168
5'5" or 65"	150	162	176
5'6" or 66"	156	167	181
5'7" or 67"	161	172	188
5'8" or 68"	165	178	193
5'9" or 69"	167	182	198
5'10" or 70"	178	189	204
5'11" or 71"	181	193	209
6' or 72"	184	198	214
6'1" or 73"	191	205	221
6'2" or 74"	197	212	227
6'3" or 75"	203	218	234
6'4" or 76"	208	225	240
6'5" or 77"	215	233	248
6'6" or 78"	221	239	255
6'7" or 79"	230	246	261

Female Officers: Subtract ten pounds from above chart to obtain maximum weight.

test to determine the current fitness status, and then assist the officer to develop a program directed at his personal need.

Results of the Program

In July 1975, at the initial weigh-in, 42 officers were found to be overweight. In July 1976, after one year, only 6 members of the department had not attained the required weight. During the first 12 months this program was in effect, only 2 officers were suspended for failure to comply with the program. Of the 6 members who were overweight in July 1976, the average amount of excess was 12 pounds.

COLORADO SPRINGS, COLORADO

This program was established in November 19[illegible]5, as the result of observations reported by line personnel pertaining to the increase in the rate of incidences of a violent nature and the awareness of the officers that fitness was required to handle these situations.

Department personnel began a campaign with the support of the new Chief of Police to encourage participation in a running and weight lifting program. Efforts were made by this group to obtain the use of a city building formerly used as a military police station. Once permission was granted, officers cleaned and painted the interior and began construction of weight lifting equipment.

The vast majority of the free weights, racks, bench press, and other equipment was constructed by department personnel. Other equipment was donated by individual officers.

Several department members who had previously engaged in weight lifting and running programs assisted others in the development of their individual programs.

Results

At the present time, approximately 50 percent of the department's law enforcement personnel exercise regularly. Efforts are being made to encourage additional participation. The police academy classes also use this facility and officers volunteer their time to act as exercise leaders for the academy class. This is done on their own time and there is no compensation for this service.

OAKLAND, CALIFORNIA

Discontinued Physical Fitness Training Program

Original departmental interest rested on improvement of defensive tactical skills. Although no studies had been conducted, indications apparently pointed to the need for a refresher course in this area for patrol officers. Accordingly, a decision of the training division commander resulted in the refresher course.

Since the OPD already required periodic range training for patrol officers, it was a relatively simple task to develop the defensive tactics program along similar lines. Training sessions were provided at the beginning of the day shift only. One officer from each of the five patrol squads reported to the police gym for a period of one hour, instead of attending roll call. The training division assumed responsibility for developing and posting the training schedule for all patrol personnel. Based on the number of officers per squad, it was intended that each officer would participate in three such training sessions during the normal six-weeks shift rotation schedule. Maximum participation during the one hour session was limited by the facilities to eight officers. One defensive tactics officer was assigned full-time to the gym to act as counselor/instructor; in addition, several officers with extensive judo training were available on a part-time basis.

No exemptions from this program were allowed, except for medical disability on approval. Bureau commanders were responsible for the participation of their subordinates according to the training schedule. Although no disciplinary actions attached to non-participation, records were to be maintained concerning both the participation and the proficiency of each patrol officer.

The problems which eventually led to the discontinuance of this program surfaced almost immediately. At the time of program implementation, day shifts began at 7:00 a.m. and 8:00 a.m. only. It soon became apparent that the one-hour time period allocated for each training session was inadequate. Thus, while the officers from the 7:00 shift were completing their session and preparing for duty, the officers from the 8:00 shift were reporting for their training session. At this time, then, there could be as many as 16 officers off the streets. Although no specific studies were conducted, it was apparent that officers who participated in this program were reporting for duty between 30 and 45 minutes late. A substantial number of officers, therefore, were not on duty during the critical early-morning rush hours. Difficulties were encountered with both traffic situations and the normal reports (e.g., burglaries) resulting from the opening of businesses. For these reasons, the defensive tactics training program was discontinued in November 1968.

Some success was achieved, in a limited physical fitness program with the Special Operations Services Unit (SOS). In 1974, a low-key, self-improvement aerobics program was created as a pilot program for SOS. An evaluative study of this program was conducted after five months. Substantial improvement was noted in the 12-minute run test as well as in officer activity level. In addition, opinion survey results from 82 percent (N=27) of the participants provided broad support for the program. An unsolicited testimonial from a doctor indicated that one participant's excellent physical condition had significantly reduced recovery time required following a knee injury. A sharp decrease in sick leave taken was also attributed to improved physical fitness.

Although the Personnel and Training Division would like to establish a similar physical fitness/aerobics conditioning program department-wide, estimated costs in terms of man-hours lost from regular duty are prohibitive at this time. General support has been obtained in theory from top administrative personnel, but the issue of taking officers off the street remains determinant. At present, a limited aerobics program has been added to the recruit academy; it consists primarily of a two-hour orientation presentation by the police surgeon.

A recent questionnaire distributed to uniformed patrol officers resulted in the startling conclusion that a 10-mile platoon-type run would produce the best physical conditioning. The only workable incentive for participation in a physical fitness training program appears to be compensatory time off.

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Administrative Approach to Physical Fitness

Perhaps the most significant result of our site visits was the discovery of three distinct administrative techniques utilized in physical fitness programs which we label voluntary, revolutionary, and evolutionary. The most common approach is voluntary.

Voluntary Approach

The department provides exercise equipment, and through interdepartmental memos encourage their officers to keep in shape. Although the most widely used approach, it appears to be the least effective.

Revolutionary Approach

The administration indicates that officers will meet certain criteria within specified times to show they are capable to perform their duties. Failure to comply with the requirements within specified periods of time result in a negative disciplinary action. Usually no assistance is offered and there is no regular program for the officers to maintain their conditioning.

Evolutionary Approach

With this method, officers receive indoctrination concerning the program, testing to determine their current status, and assistance in meeting the requirements. After a time when all personnel have had the opportunity to comply, the program becomes one of mandatory compliance.

CHAPTER 8

ADMINISTRATIVE AND DEVELOPMENTAL CONSIDERATIONS AND RECOMMENDATIONS

Based upon the information gathered during our research and especially the information reported in chapters 3 and 5, we recommend that police agencies begin preparation to implement a preventive medicine program for police officers of all ages. This includes educational information on good health habits and proper diet as well as exercise programs.

There are, however, several administrative and program development problems which must be considered prior to the implementation of these programs. Each department has unique characteristics, attitudes, and problems which will require individualistic approaches to the implementation of our recommended programs. This chapter will discuss a systematic approach to these problems and offer suggestions which will assist the administrator in establishing his policy toward physical fitnes programs for police officers.

In chapter 7, we identified three administrative approaches to physical fitness programs. Because the success or failure of any program is often determined by the initial approach implemented by the administrator, a further discussion of these approaches is warranted.

The Voluntary Approach can be generalized as laissez faire or a cavalier attitude toward the problem. There may be an initial turn out of volunteers for a physical fitness program, however, interest wains very rapidly once a program is underway. This was shown in the experimental exercise program conducted in conjunction with this study and was also observed in site visits to many police agencies. Voluntary programs are simply not effective in keeping officers fit.

The revoluntionary approach to physical fitness is perhaps the most controversial method of program implementation. In general, these programs will create personnel grievances and in some instances result in court actions. The revolutionary approach establishes fitness standards and imposes negative disciplinary actions for those failing to comply. The greatest problem with this approach is lack of communication. Management may be well aware of the problems. They may also be viewing the long range benefits personnel would derive from improved fitness. However, they fail to inform their personnel. In some instances, fitness standards are imposed but nothing is done in the way of program assistance for personnel to attain the desired goals. Programs which are implemented using this approach can expect non-compliance, personnel problems, difficulties with collective bargaining groups, and most important, failure to meet the desired objectve.

We recommend the Evolutionary Approach in program planning and implementation. This approach allows management to plan their program step by step in a series of tasks. These tasks follow in sequence and one objective is completed prior to beginning the next. This method also allows the greatest flexibility in making adjustments to the program goals.

Identification of the Problem

Although we have discussed the overall fitness levels of police officers in previous chapters of this manual, each department should seek to discover the general fitness levels of its personnel. A preliminary analysis may be accomplished by examination of existing personnel records and departmental reports.

1) Determine the average age of members of your agency. This will provide information concerning the probable fitness level of personnel based upon the findings reported in Chapter 3.
2) Determine the number of sick days utilized by personnel during the last calendar year. Compare this total with several previous years and determine if there has been an increase. If an increase occurred, determine if there is a correlation between the increasing average age of personnel and number of sick days utilized.
3) Compare the time lost due to on-duty injuries for at least two years.
4) Analyze the medical reasons given for early retirements and medical related deaths of personnel during the past several years and list in rank order the causes, i.e., if coronary heart disease was the cause listed in the majority of cases it would be ranked number 1.
5) Compare and list in rank order the medical reasons personnel were placed on limited duty for several years.
6) If your department has periodic medical exams or requires personnel to weigh in on a regular basis, determine if an increase in body weight is occurring among officers.

Although this list may be supplemented with additional information, the data collected should give you a preliminary indication of the need for a physical fitness program. A cost analysis of sick time, on-duty injuries, limited duty, early retirement and premature death will reveal the current costs that may be partially recovered with the advent of a preventive medicine program.

Information Dissemination

The final step in problem identification is medical screening and fitness evaluation tests for each officer. However, it is recommended at this point that personnel be informed of the preliminary findings within the department, the general information concerning police and physical fitness contained in this manual, and the administration's concern toward employee physical fitness. This information can best be disseminated at an in-service training session. In this setting personnel should have the opportunity to express their personal views towards a physical fitness program and provide feedback concerning attitudes and perceptions of these programs. The agenda at this in-service training session should also discuss the medical screening and fitness evaluation procedures described in chapter 10.

In the event that in-service classes cannot be scheduled, a departmental memorandum should be distributed to each officer. The memorandum should explain in detail the preliminary findings within the department as well as the information concerning fitness levels of police contained in this manual. The Summary of this manual provides adequate information for a memorandum.

Medical Screening

These tests, described in chapter 10, should be conducted prior to evaluating the fitness level of police personnel. The department physician or medical consultant will assume control of this phase of the program. The rationale for conducting these tests is the reduction of risk to officers who may have undetected medical problems.

In small agencies which do not employ a physician or medical consultant or those departments which do not require annual physical examinations, officers should be examined by a personal physician and those tests suggested in Chapter 10 as minimal medical screening evaluations should be conducted.

Staffing the Physical Fitness Unit: The selection of personnel to conduct the physical fitness program should be considered by the administrator from the outset. Obviously, the number of persons assigned to this function will vary according to department size and resources. In all cases, however, there should be at least three assignments: Medical Director, Program Director, and Exercise Leader.

The Medical Director should be a licensed physician. This position should be assigned to the department physician or consultant. The physician will work closely with the program director in determining the status of health of each employee. He should also conduct the medical screening tests. It becomes the responsibility of the medical director to assure that the evaluation phases of the program are conducted in a safe manner.

The Program Director should be or become an exercise specialist, highly trained in the area of fitness evaluation, program development and implementation, and exercise physiology. This training can be obtained through workshops conducted at The Institute of Aerobic Research, located in Dallas, Texas, and the Physical Education Department at the University of Wisconsin, and training programs which will be implemented in the near future by the International Association of Chiefs of Police. The program director must work with the medical director in establishing exercise testing procedures; prescribing proper exercise programs for officers and supervising all physical fitness activities.

The Exercise Leader should be well versed in exercise and physical education programs. He should be thoroughly familiar with the exercise programs discussed in Chapter 11. He must have the ability to teach officers the proper way to exercise and assist them in maintaining their exercise regimens.

Fitness Evaluation: The next task to be accomplished is the officer fitness evaluation. Each employee should participate in this process. This battery of tests offers a comprehensive testing program for police. If time, money, and equipment are available, other tests can be included. For example, the assessment of maximum oxygen intake is an excellent test, but is considered a luxury in an evaluation program. Maximum oxygen intake can be estimated accurately with time on the treadmill, heart rate response to a submaximal bicycle or bench step test, and the 12-minute run test. The recommended evaluation procedures are discussed in detail in Chapter 10. These procedures have been categorized as Laboratory Procedures and Field Test Procedures for the purpose of providing high to low-budget options. Chapter 10 also details recommended police officer fitness standards in three age categories: Ages 20-29 years; 30-39 years, and 40-52 years. Fitness profile charts are included for each age group and are divided into categories of Excellent, Good, Average, Below Average, and Poor.

Counseling: Following the fitness evaluation examination each individual officer should meet with the program director or exercise leader to discuss his current start of physical fitness. A complete fitness profile on each person examined should be available. Tables 10.19 through 10.24 are examples of the forms that can be utilized for this purpose. The officer should also be counseled in the type of exercise program which would be most beneficial to him. Chapter 11 provides detailed information on recommended exercise programs for all age groups and fitness categories.

Once the above listed tasks are completed, the administrator will have a complete picture of the fitness level of his employees.

Establishing Departmental Fitness Policy: The agency must now establish a formal physical fitness policy. The creation of this policy should take into consideration the current fitness level of personnel and the establishment of acceptable levels of fitness for officers in all age groups. The medical director and program director should participate in the creation of this policy. It is recommended that height weight standards be established concurrently. Weight standards should consider the entire body composition including percent body fat as described in chapter 10.

The formal policy should indicate a future date when all personnel will be required to conform to the established level of fitness for all age groups. This date should be determined by utilizing the initial fitness profiles compiled during the fitness evaluation task. The administrator must consider the fact that personnel fitness did not decline overnight and cannot be re-established immediately. Regaining acceptable levels of fitness will require a considerable length of time for some individuals. The policy should also describe the department's fitness program and implementation plans.

Program Implementation

At the time formal policy announcements are made, the administrator should detail the department's fitness program. This can best be accomplished during in-service training sessions. However, Roll Call Training sessions or printed handout material describing the program can also be effective. If programmatic information is disseminated at roll call, it is recommended that physical fitness project personnel conduct the briefing. This allows officers the opportunity to ask questions, and provide feedback to the program director.

The Program: When the employee has completed the fitness evaluation examination and the results are analyzed, the program director should write an exercise prescription for each officer. Exercise prescription is dependent on needs (job description, likes and dislikes, etc.), goals, physical and health status, age, available time, equipment, and facilities. These factors vary greatly among police, therefore, the individual approach to exercise prescription is recommended (1,2,5,12). Officers in the field have a greater need for muscular strength exercises than the police executive. Thus, training for the field officer should emphasize both cardiorespiratory endurance training and muscular strength exercises.

As an officer gets older the need for a preventive health program becomes more evident. Thus, as an officer gets older, emphasis should be placed more on the development and maintenance of cardiorespiratory fitness. The initial experience with endurance training should be of low to moderate intensity and progression which allows for gradual adaptation. On the basis of experience with adult programs, the abrupt approach can result in discouraging future motivation for participation in endurance activities. Improper prescription also can lead to undue muscle strain or soreness, orthopedic problems, undue fatigue, and risk of precipitating a heart attack.

We recommend that all personnel whose total fitness profile (see chapter 10) places them in the "below average" or "poor" categories, be scheduled for supervised training sessions and exercise indoctrination. These supervised sessions should take place three days per week for one hour each scheduled day. The officer will receive assistance in beginning a starter program, described in chapter 11, and assistance in learning to exercise independently.

In those cases where time, money, or other resources preclude conducting training sessions for these officers three days per week, the program director should conduct an initial training session for this group. The curriculum should include information on the various starter programs, the use of the exercise log, the importance of warmup and cool-down periods, instruction on pacing themselves, and how to count their heart rate properly.

These officers should then be required to report to the program officer one day each week to report their progress and turn in their exercise log.

Officers whose fitness profile is "average" or above should also be required to attend an initial training session. Because their exercise program will differ from the "below average" group, these officers will be exercising independently after the initial training session, however, the curriculum should include instructions in pacing, recording heart rate, and use of the exercise logs.

These following guidelines are directed toward the average policeman who requires an exercise program to develop and maintain cardiorespiratory fitness and desirable body fat composition and muscle tone. The guidelines are geared to the healthy officer who is not physically disabled, and has approximately one hour of time available 3 to 5 days per week. The program director must consider several factors in prescribing exercise: frequency, intensity, and duration of training; mode of activity, and initial level of physical fitness (2,3,9,13). In general, for the purpose of developing and maintaining a good cardiorespiratory system and keeping the body composition in proper proportions, the prescription should include a frequency of 3 to 5 days per week, intensity between 60 and 90 percent of maximum, and duration of 15 to 45 minutes. The mode of activity can be any sustained endurance type such as fast walking, running, bicycling, or swimming. Game activities also are good modes of activity if they are a sustained effort and not too intermittent. The initial level of fitness is quite important because persons with low levels do not adapt as well to exercise regimens and thus should have programs of lower intensity and longer duration. Listed below are some findings observed during exercise programs over the past ten years:

1. Improvements in physical fitness are related directly to frequency, intensity, and duration of training (13,18).

2. If the intensity is between 70 and 90 percent of maximum, the frequency between 2 and 5 days per week, and duration of 30 to 45 minutes, a significant cardiorespiratory response to exercise can be attained (10,11,14).

3. If diet is held constant, body weight and fat changes do not occur in programs of less than 3 days per week (10,11,14).

4. Intensity and duration are interrelated and, in general, the total energy expenditure of the program is the most important factor. If participants work at a higher intensity such as in a running program, then the duration does not need to be as great as for a moderate intensity program (2,11,13). For middle-aged and older individuals, a moderate intensity program of longer duration is recommended (2,3).

5. If the first four items are taken into consideration, the mode of activity appears to be independent of the training effect (2,15).

6. Older people with lower levels of fitness take longer to adapt to exercise. If given the proper adaptation period, they can progress to a satisfactory level of physical fitness (16).

7. Recent results show a significantly higher incidence of injury due to musculoskeletal problems for beginning runners due to increased frequency and duration of training. Thus, a recommended program for beginners is to intersperse a day of rest between days of activity and to limit duration to 15 to 30 minutes. The exception to this recommendation is if participants are engaged in a moderate walking program (17). These seven findings, plus the results shown in chapter 3, should give better inference to the program director as to the rationale for the exercise prescription recommended for police officers. Complete descriptions of various exercise programs is found in chapter 11.

Each exercise session should include a 10 to 15 minute warmup followed by a 15 to 45 minute endurance activity period and conclude with a 5 to 10 minute cool-down (2,3). An exception to this would be the officer in the field who needs an extra 10 to 15 minutes for strength training. In prescribing exercise, it is best to think of a program as initially developmental in nature and progressing to a maintenance regimen (2,3). Those having a lower level on the fitness scale require a longer developmental period. A starter program for the developmental phase should include low to moderate intensity activities, and stretching and low to moderate intensity calisthenics. After the participants have adapted to that level of activity, the exercise requirements should be progressed. The increase in workload should occur each week or two weeks until the participants reach the maintenance level of fitness. Unfit or older individuals require longer adaptation periods and slower progression periods. After age 30, it is estimated that the increase in time for adaptation is approximately 40 percent per decade; that is, if 30-year old participants progress every 2 weeks, the 40-year old group advances approximately every 3 weeks, and the over 50 individuals, every 4 weeks. In general, the starter program will last from 5 to 10 weeks, followed by a 3 to 5 month slow progression period, and reaching the maintenance program in 6 months to a year.

Recordkeeping for quantifying the program is another important phase of the exercise prescription. Appendix B shows an example of an exercise log form used at The Aerobics Center, Dallas, Texas. A form similar to this was used in the study on police officers. The log lists a variety of exercises which the participant can record, and thus, the aerobic point (oxygen cost) values of the program can be evaluated. For ease of use, the aerobic point system can be computerized, which facilitates data quantification and feedback to the program director and participant.

Officers should be taught to monitor their own programs, specifically to pace themselves and to count their heart rate properly. In a run-walk type program, participants usually are training on a known distance course and can pace themselves with a stopwatch or wrist watch with a sweep second hand. The accuracy of keeping pace can be improved by providing known distance reference points every 100 to 110 yards. Heart rate is easy to count and relates well to oxygen costs (4). The participants should count the heart rate as quickly as possible after cessation of exercise before the heart rate begins to decrease (7). The best method for assessing heart rate is to count beats per 10 seconds at either the carotid artery (neck area) or by placing the palm of the hand over the apex of the heart. With concentration and practice, this method has proven to be very accurate (12).

In general, walking programs range from 50 to 75 percent of maximum heart rate and jogging-running programs, from 80 to 95 percent of maximum. Programs that sustain the heart rate over 90 percent of maximum are considered to be high intensity work (11). Most people jog at approximately 85 percent of maximum heart rate. The percent of maximum heart rate should be determined by subtracting the resting heart rate from the maximum heart rate (12). Failure to take the resting heart rate into consideration may cause the energy cost of the activity to be overestimated (4).

Program Coordination

A comprehensive preventive medicine program does not end after the above tasks are accomplished. It is recommended that the program director and his staff establish a schedule of clinical workshops. These might include stop smoking clinics which can be arranged through the local chapter of the American Cancer Society; police family weight watchers club; an alcoholic annonomous chapter, and other general health and physical fitness lectures. Generally, these programs can be provided at no cost through community groups. It is recommended that meetings be conducted during the evening hours and invite the officer to bring his wife and other interested family members as guests. These programs can generate new interest in the officers to continue good health practices. It is not difficult to motivate people to exercise for a few weeks or months in order to develop significant improvements in their physical fitness status; however, it is difficult for a lifetime. One of the major obstacles the program director will encounter in coordinating the fitness program is one of motivation and adherence to prescribed exercise.

Motivation and Adherence

The aspects of motivation which tend to be successful are good supervision, proper exercise prescription, individualized exercise prescription, group participation, setting realistic, intermittent goals, periodic evaluation, variety in the program, desirable environment, low-key competition for motivation, periodic awards, and education. During the experimental programs conducted during this study, we experienced drastic adherence difficulties. In chapter 7, we discussed this issue and concluded that many of the adherence difficulties encountered were created by the experimental nature of our program. Other exercise programs have experienced a great deal of success, however, they utilized group activity as a motivator. Although many persons enjoy exercising alone, training in groups usually adds to adherence (19). Program directors should review Exercise Testing and Exercise Training in Coronary Heart Disease, edited by J. Naughton and H. Hellerstein, Academic Press, 1973, for a thorough discussion of the social aspects of exercise. The role that family members play in program adherence is also most important. The role of the officer's spouse in our experimental program was discussed in chapter 6. The influence of wives has also been reported in other studies. Heinzelmann and Bagley discovered in a study of men ages 45 to 59 years old that while members of an exercise group did not view their decision to participate as having been greatly influenced by their wives, a wife's attitude or feelings about the project significantly influenced the husband's decision to continue in the 18-month program (6).

It is recommended that the spouse of the officer be advised of the department fitness policy, and receive the results of the officer's initial fitness evaluation examination. The spouse should be encouraged by the department to exercise with the officer and become involved in the total preventive medicine program.

Once the officer has completed a starter program, participation in a variety of activities is recommended and can be accomplished by interchanging various activities. Choosing different activities tends to keep a participant interested in endurance exercise over a long term period. For example, one might jog 30 minutes on Monday and Thursday and play handball or basketball on Tuesday and Friday. Also, running through the woods or in parks rather than around the track appears to make exercise more interesting. Likewise, many exercise leaders use music in conjunction with their exercise programs. The important factor is that the person participates in these activities frequently and with sufficient intensity and duration.

Another motivator which should be considered is recognition of achievement. Individual or unit commendations may be awarded. A uniform decoration for physical fitness achievement might be created or, a chief's or superintendent's trophy might be awarded to the unit on a yearly basis to the group who has the highest general fitness level.

The most significant motivator will be the realization of the individual officer that he is in better condition and more physically fit to perform his duties.

Reevaluation: Providing the officer with information concerning his progress is also a necessary factor leading to adherence. Periodic evaluations are important to program coordination and should be scheduled 8 to 10 weeks after program initiation for officers who are initially rated below average. Re-evaluation for all personnel at least annually is recommended. This feedback will provide the officer with a progress report and also permit the program director with data to audit the individual employee's exercise logs. At this time, alterations in exercise prescription and in department programming can take place depending upon results. The field tests discussed in chapter 10 should be utilized for re-evaluation.

Reporting

One of the problems discovered during the conduct of this study was the lack of available information concerning the physical activities of officers.

We also found that few agencies could provide accurate information concerning the medical problems of officers. In order to provide proper program evaluation and results of the physical fitness program, we recommend that agencies adopt the following minimal reporting procedures:

Daily Activity Log

In chapter 7, we reported the frequency of certain physical tasks officers reported they encountered in their assignments. These tasks included: foot chase; climbing a fence; running upstairs; pushing a stalled car; lifting a sick or injured person; struggling with a suspect; separating fighters; climbing a ladder, and lifting a heavy object. It is generally a combination of several or all of these tasks which are included in the majority of agility tests conducted for applicants or which are administered for most periodic fitness evaluations.

The majority of departments do not presently record physical task data which can justify these activities as being job related. Although it is recognized that an officer must do all of these tasks from time to time, our study indicated that officers are rarely required to perform these activities. We recommend that departments require officers to submit this type of information on a daily basis. This can be accomplished by using a portion of the existing daily activity log for this purpose. Abbreviations such as FT. CH._____for fast chase and CLB. FN._____for climbing a fence with a small space to record the number of times this activity was performed, should be included in the daily summary section of the form. Each of the ten items should be included plus a space for Other _____ Describe______ for other physical activity. As this data is transferred to the officer's monthly and yearly activity records and as the shift totals are recorded daily and monthly, the department will soon have an indication of the physical activity their officers are required to perform. At the end of a given period of time, the total in each category can be placed in rank order. This information can then be utilized for evaluation and adjustment of existing performance requirements. This data is also valuable in the event the department is required to justify a certain task in the applicant selection examination or annual agility requirements.

Fitness Profile Chart: A fitness profile chart should become a permanent document in the officer's personnel file. A specimen of this form is found in chapter 10.

Individual Exercise Log: An example of an individual exercise log is located in Appendix B. These forms should be submitted by all personnel on a monthly basis. The completed and signed forms should be retained by the program director for a one year period or until the officer has been re-evaluated. Upon completion of the re-evaluation, project personnel should compare the results with the officer's monthly log. In the event that improvement was not shown and the officer has recorded regular workouts, lack of fitness adherence is indicated and proper action can be taken. This officer should be counseled and placed in a supervised program.

Cost Effectiveness Forms: A form should be created which will record, on a monthly basis, the number of sick days taken by all sworn officers, the number of injury days, and the limited duty assigned to officers who report that participation in the fitness program was the cause of illness or injury. A decrease in the number of sick days should be eventually realized.

Self-initiated Activity Form: To determine the effectiveness of the fitness program as it related to increased productivity, it is recommended that an analysis of the self-initiated activities of officers be conducted. This requires a study of the daily or monthly activity summary for at least six months prior to the time the officer begins his physical fitness evaluation. The amount and kind of activity the officer has conducted without receiving a radio call should be recorded. Car and pedestrian stops, recovered stolen autos, traffic violations, and self-initiated arrests, are examples of the type of data required. After the officer begins his physical fitness program, the self-initiated activities should be recorded and percent increase or decrease over past performance is noted.

This information can then be used as an indicator of the effect physical fitness has on the officer's work performance. Other factors will effect these kinds of activity including shift, patrol area, weather conditions and the like. However, an increase in self-initiated performance should be realized over time. Officers in the experimental program reported that after engaging in exercise programs, they experienced a favorable change in their general level of activity, ability to rest, amount of fatigue, and job satisfaction. This general improvement should be reflected in the officer's work performance. The administrator must be able to report the effectiveness of all department activity. The recording and analysis of the above listed information is necessary for the overall evaluation and cost effectiveness of physical fitness programs.

The cost effectiveness of physical fitness programs is abstract and long range. The use of an analogy between physical fitness and other accepted departmental programs is useful when discussing cost-effectiveness. Police agencies engage in all of the following maintenance activities:

(1) vehicle maintenance
(2) uniform maintenance
(3) building maintenance
(4) equipment maintenance

If monies are not allocated for the above maintenance programs, police vehicles would not operate, officers would not display a professional appearance, the police buildings would become uninhabitable, and radio and other equipment necessary for an efficient police agency would break down. In other words, without preventive maintenance, the department would cease to be an effective force. Without preventive maintenance, a police automobile would probably last less than three months.

The most valuable tool in any police organization is manpower. We must be as concerned with personnel as we are with automobiles. Therefore, if for no other reason than common sense, physical fitness IS cost effective. The amount of money saved over and above the cost of the program will always be as evasive as the amount of crime prevented by conventional patrol methods. Cost-effectiveness of physical fitness programs should be considered in terms of better prepared personnel, reduced sick and injury time, fewer limited duty assignments, less early retirement, and decreasing premature death of officers. Only with implementation and evaluation of these programs can the cost-effectiveness be realized.

The budgeting cost categories described in this portion of the manual should be viewed as theoretical. Actual program costs will vary depending upon the type of program initiated. type of evaluation procedures, and number of personnel assigned to the physical fitness program unit.

I. Necessary Equipment. Departments which desire to establish a minimum evaluation and fitness program should obtain the following equipment:

1 Bench 12" high for step test
1 Clock with sweep second hand or
1 Stopwatch for timing test and counting heart rate
1 Metronome to assist in maintaining proper stepping cadence
1 Stethoscope to count heart rate during recovery period
1 Skinfold Fat Caliper for determining percent body fat
1 Tape Measure (steel) to record waist girth
1 Physician's Scale
1 First Aid Kit with resuscitator for emergency use
1 Multi-station Weightlifting Apparatus or free weight (Barbells) to assess strength

Although the above equipment is all that is necessary to conduct the recommended programs, the list must be adjusted according to number of officers and staff personnel. On the following page is an equipment list which is required for sophisticated evaluation examinations.

II. Personnel Costs

A.	Medical Director	$annual salary
B.	Program Director	$annual salary
C.	Exercise Leader	$annual salary
D.	Clerical Personnel	$annual salary

III. Office Supplies and Equipment $ ________

IV. Program Costs

A. One in-service training day for each officer during information dissemination process $ ________

B. One in-service training day for each officer to explain departmental policy $ ________

EQUIPMENT LIST

ITEM	USE	COST RANGE
Sphygmomanometer	Blood pressure	$100-$300
Stethoscope	Heart rate	$5-$50
ECG recorder	ECG	$1000-$5000
Patient Cables	ECG	$100-$500
Oscilloscope	ECG	$800-$4000
ECG cart stand	ECG	$500-$1000
ECG supplies (electrode discs, paste, creme, paper, tape, etc.)	ECG	$500-$2000
Stretcher bed	ECG	$300-$500
Stopwatch	Timing	$50-$100
Step Bench	Stress test	$50-$100
Metronome	Stress test	$100-$300
Treadmill	Stress test	$3000-$8000
Cardiotachometer	Heart rate	$1000-$3000
Bicycle ergometer	Stress test	$500-$1200
Oxygen Automatic Analyzer	O_2 analysis	$5000
Carbon Automatic Dioxide Analyzer	CO_2 analysis	$5500
Lloyd-Gallenkamp Analyzer	Calibrate automatic analyzers	$800
Parkinson-Cowen Flowmeter	Measure air volume	$1000
Respiratory supplies (valves, hoses, mouthpieces, bags, etc.)	Oxygen uptake	$2000-$5000
Barometer	Air pressure	$300-$1000
Sling Psychrometer	Relative humidity	$100-$300
Calculator (programmable)	Calculate results	$400-$1200
Spirometer	Lung function	$1200-$5000
Skinfold Fat Caliper	Body fat	$125
Tape measure (steel)	Body size	$150
Physician's scale	Body weight	$300-$1000
Universal Gym Apparatus	Strength	$3000-$5000
Defibrillator	Emergency	$1500-$5000
First Aid Kit (with resuscitator)	Emergency	$200-$500

ADDRESSES FOR EQUIPMENT SOURCES

Acme Scale Company
5303 Adeline Street
Oakland, CA 94608
415-654-1677

W.A. Baum Company, Inc.
620 Oak Street
Copiague, L.I., NY 11726

Beckman Instruments, Inc.
3900 River Road
Schiller Park, Ill. 60176

Cambridge Scientific Industies
101 Virginia Avenue
Cambridge, MD 21613
301-228-5111

W.E. Collins, Inc.
220 Wood Road
Braintree, MA 02184
617-843-0610

Dynasciences
Township Line Road
Blue Bell, PA 19422
215-643-0250

Everest & Jennings, Inc.
1803 Pontius Avenue
Los Angeles, CA 90025
213-879-1131

Franz Mfg. Co.
New Haven, Conn.

General Medical Dallas
304 N. Walton
Dallas, Tx 75226
214-747-9888

Hewlett-Packard
19310 Pruneridge Avenue
Cupertino, CA 95014
800-538-7922

Medical Research Labs, Inc.
1873 Busse Highway
Des Plaines, Ill. 60016
312-298-1960

Meylan Stopwatch Company
264-266 West 40th Street
New York, NY 10018
212-391-9150

Quinton Instruments, Inc.
2121 Terry Avenue
Seattle, WA 98121
206-223-7373

Salem Sales Assoc.
P.O. Box 9323
Charlotte, NC 28205

Texas Instruments M/S 358
Box 22013
Dallas, Tx 75222

Universal Athletic Sales
1328 North Sierra Vista
Fresno, CA 93703
209-251-4251

C. One in-service day for each officer for medical screening $ ____________

D. One (minimum) in-service day for each officer for initial evaluation and counseling $ ____________

E. One in-service day for each officer every six months to one year for re-evaluation and counseling $ ____________

V. Printing of necessary forms for recording and maintaining evaluation $ ____________

VI. Supplemental Programs
(Cost of preventive medicine workshops or clinics sponsored by the agency) $ ____________

This budget outline should provide the administrator with a preliminary cost for beginning a physical fitness program. In those agencies which desire to conduct sophisticated evaluation programs, the medical director, police physician or medical consultant, should be aware of medical or educational facilities which are capable of conducting cardiovascular-respiratory and pulmonary function tests. Hospitals, colleges, and sports clinics should be contacted. The cost to the police agency to have these evaluation examinations conducted outside the department will cost between $25.00 to $300.00 per officer depending upon the financial agreements reached. However, the total cost for the initial evaluation will be less than that required if the agency desires to purchase its own equipment and hire medical personnel and exercise psysiologists to conduct these examinations.

Other Administrative Considerations

Police Unions: In those agencies where administrative consideration must be given to the reaction of police unions or collective bargaining groups before program implementation, it is recommended that lines of communication be opened during the planning process. Union leaders should be informed that consideration is being given to this program and the administrative reasons why the program is important for the union membership. In those cases where organizational opposition is anticipated, the administrator should consider the issue of physical fitness evaluation and exercise programs as a Management Productivity Proposal at the next bargaining session ,see "Improving Police Agency and Employee Performance Through Collective Bargaining", John H. Burpo, in Collective Bargaining in the Public Sector, R. Ayres, T. Wheelen, ed., IACP publication, 1977.

The majority of union leaders with whom contact was made during the course of this study did not object to the advent of physical exercise programs. They did object, however, to the policy of requiring officers to qualify regularly in an agility or physical performance test in those agencies which do not provide assistance or facilities for the officer to maintain good conditioning.

Line Personnel Participation: Officers throughout the country expressed the opinion that participation in planning a fitness program would enhance participation and adherence. It is recommended that line and staff personnel of various ranks be selected to form a physical fitness participatory management team. This group could perform the tasks described in the section of this chapter concerning problem identification. They can also serve as a department physical fitness advisory committee and provide input in the evaluation of the program.

Disciplinary Procedures for Noncompliance

One very definite factor that must be taken into consideration is the policy toward those officers who fail to comply with departmental policy and standards of fitness. Failure to take corrective measures will be viewed as a relaxation of the standards by other personnel and will result in a failure to meet program goals. Administrators must determine the action necessary in his agency. These measures may range from required supervised instruction to suspension, and in some cases, dismissal. Whatever measures are instituted to assure compliance, they must be tempered with the consideration that the officer has been given adequate medical and physical evaluation, counseling assistance, and time to meet the established standards.

Suspension or dismissal may result in legal issues. In the next chapter, we consider the legal issues surrounding physical fitness that have resulted in litigation. This review of court decisions covers a wide range of issues directly and indirectly concerned with the health and physical qualifications of police officers.

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CHAPTER 9

LEGAL ISSUES

The law recognizes the importance of physical fitness in the law enforcement profession. Although legislation has not been prolific, nor litigation extensive, there is evidence that courts and legislatures are striving to balance the pressing needs for effective law enforcement with the constitutionally protected interests of individuals. Police department personnel, or applicants for jobs as police officers, may challenge statutory age requirements, allegedly wrongful dismissals, allegedly discriminatory entrance requirements, or the propriety of promotional standards on the constitutional grounds that such requirements are discriminatory and therefore violate the equal protection clause of the 14th Amendment. In looking at such issues, however, it must be remembered that unusual physical demands in law enforcement work separate the police profession from other public service employment, therefore may justify the promulgation and application of strict physical fitness requirements for police officers. Although courts usually have supported this concept by taking the position that, when the welfare of the community is at stake, traditional equal protection standards may justifiably be relaxed, police department entrance requirements have been invalidated because their usefulness in predicting successful job performance was insufficient to justify their discriminatory impact.

To better prepare their police officers for carrying out law enforcement duties some legislatures have passed statutes such as those in Georgia and Connecticut, Georgia Code Ann., Ch. 92A-21 and Conn. Gen. Stats. Ann., §§7-294a - 7-294e, which ensure that newly hired police officers have received some minimal amount of training and attained a specific level of competence in a program or school designed by the state. The Alaska Police Standards Council is authorized in Alaska Statutes, §§18.65.130 - 18.65.290, to devise programs for continuing education and physical training. Similar legislation in other states is likely to be forthcoming.

Special Legal Problems Relating to Physical Fitness

Because law enforcement work at times demands that police officers do tasks involving physical exertion while being able to cope with stress, certain problems crop up which, if not unique to police departments, at least require special attention. Problems such as excessive weight or alcoholism, which may have an impact on physical performance become more serious when viewed in the context of law enforcement. A brief look at some of these problems and how they are dealt with is presented below.

Age

Nearly every state makes some provision for minimum and maximum age limits for hiring police officers. Typically, these statutes require that persons applying for the position of police officer be between the ages of 18 to 21 years, and 35 to 45 years. Statutes also commonly provide for mandatory retirement at a specified age regardless of the officer's health or physical condition. One of the latter provisions was recently upheld by the Supreme Court in the case of Massachusetts v. Murgia, 49 Law. Ed. 2d 520 (1976).

In that case, the law in question provided for mandatory retirement of police officers at the age of 50. The complainant, who had been involuntarily retired, claimed that he was being denied equal protection of the law. After hearing arguments, the Court determined that as a matter of fact, the duties of police officers are physically taxing, and that there is a general relationship between advancing age and decreasing physical capabilities. The increased risks, concluded the Court, are particularly significant in the cardiovascular system, and the task of evaluating those risks in any particular individual would require detailed study. The Court did agree that persons over 50 years of age could be physically able to function as police officers and conceded that the plaintiff-officer in this case was in excellent physical condition at the time of his retirement. Nonetheless, the Court held that the statute was a rational attempt to achieve the state's goal of protecting the public by assuring the physical preparedness of its officers. The Court felt that the officer had failed to show that the mandatory retirement requirement had the effect of excluding significantly large numbers of qualified officers so as to render the requirement irrational and invalid.

The Murgia case, it should be noted, was decided on constitutional grounds only. The plaintiff did not argue, and the court therefore did not decide, that the mandatory retirement statute violated the Age Discrimination in Employment Act of 1967, 29 U.S.C. 621 et. seq. (ADEA).

ADEA protects individuals between 40 and 65 years of age from discrimination on the basis of age in employment procedures and practices. Employers covered by the Act are prohibited from engaging in hiring, discharge, or retirement practices that treat individuals between 40 and 65 years old differently from those who are younger. The Act also forbids limiting or denying employment opportunities to this group, and prohibits discriminatory terms and conditions of employment. States and political subdivisions of states have been covered by the Act since it was amended in 1974.

A major exception to the Act allows employers to use age as an employment standard if they can show that age is "a bona fide occupational qualification necessary to the normal operation of the particular business." Age may, therefore, lawfully be used in some cases to disqualify job applicants. A Federal Court of Appeals noted, in *Spurlock v. United Air Lines*, 485 F.2d 216 (10th Cir. 1972), that "when the job clearly requires a high degree of skill and the economic and human risks involved in hiring an unqualified applicant are great, the employer bears a correspondingly lighter burden to show that his employment criteria are job related." For example, bus companies have been granted bona fide occupational qualifications exemptions with respect to maximum age in the hiring of drivers in two cases: *Hodgson v. Greyhound Lines, Inc.*, 499 F.2d 859 (7th Cir. 1974), *cert. denied sub nom. Brennan v. Greyhound Lines, Inc.* 419 U.S. 1122 (1975), and *Usery v. Tamiami Trail Tours, Inc.*, 531 F.2d 222 (5th Cir. 1976). It would seem to follow that law enforcement agencies should likewise be included in the exception. However, in *Aaron v. Davis*, 414 F. Supp. 453 (E.D. Ark. 1976), a mandatory *retirement* age for firemen was found to be violative of ADEA. So, at this time, it is unclear how the ADEA will affect police department employment practices, and, correspondingly, what the long-term impact of *Murgia* will be.

State court decisions have thus far generally followed the same line of reasoning that was applied in the *Murgia* decision. In the Minnesota case of *Fabio v. City of St. Paul*, 126 N.W. 2d 259 (Minn. 1964), the court held that mandatory retirement at age 65 for employees on the police payroll was valid, even though some employees avoided retirement by transferring to more sedentary positions on other payrolls within the department.

Nor, apparently does the fact that a city charter permits an officer who has reached retirement age to apply for extended service mean that an otherwise competent officer will be granted such a privilege. The Michigan Court of Appeals held, in Glinski v. City of Detroit Policemen and Firemen Retirement System, 34 Mich. App. 161, 190 N.W. 2d 728 (1971), that the Retirement System's Board of Trustees is not required to make exceptions to the retirement provisions, although it is authorized to do so, even though the requesting officer is in good health, fully qualified, desirous of continuing on the force, and recommended for continued service by the police commissioner. Rather, it said, the burden is on the other officers of retirement age and, therefore, permitted to continue.

In another case, the special treatment accorded members of the police department by a statute dealing with retirement was approved. In Geary v. Retirement Board of Alleghany County, 426 Pa. 254, 231 A.2d 743 (1967), a Pennsylvania court held that a statute which lowered the retirement age for police officers having 20 years of service to 55 years is not unconstitutional, even though other county employees were not entitled to retirement benefits until they reached 60. A policemen's greater need for physical fitness and his greater exposure to physical hazards were said to justify the difference in treatment.

Like mandatory retirement age provisions, minimum and maximum hiring age requirements for police officers have been sustained against equal protection challenges. As in other cases, the rationale has been that the nature of police work, by requiring "special attributes of agility, alertness and dexterity," demands special consideration. In Ridaught v. Division of Florida Highway Patrol, 314 So. 2d 140 (Fla. 1975), the plaintiff challenged a 35 year maximum age limit when seeking reinstatement to the force. He had already served for eleven years but had resigned twice - once to engage in private employment and once to accept a short-term appointment from the governor as a constable. The court ruled in favor of the employer, the Florida State Highway Patrol, holding that it properly took the normal hiring requirements into account in determining whether, in its discretion, it would reinstate the officer.

Height

The use of minimum or maximum height requirements as criteria for hiring has come under criticism, especially when they have not been shown to be necessary for satisfactory job performance, or when the standard set has discriminated against certain ethnic groups or females. This happened in Officers for Justice v. Civil Service Commission, San Francisco, 395 F. Supp. 378 (N.D. Calif. 1975), where a Federal Judge enjoined the use of minimum height requirements for the selection of police officers. Other aspects of this case are discussed below.

Weight

Although a police officer's weight may determine his ability to perform law enforcement tasks, court challenges to minimum and maximum weight standards have arisen in areas not directly related to police work itself. As shown in this section, issues such as departmental discipline and eligibility for retirement benefits are as likely to arise through challenges to the standards brought by individuals already employed as police officers as are equal protection challenges brought by *those excluded from employment* as police officers by their inability to conform to the standards.

In Hatfield v. Arizona Highway Patrol Merit System Council, 97 Ariz. 24, 396 P.2d 256 (1964), a patrolman was hired by the Arizona Highway Patrol although at the time his weight exceeded the regulation maximum of 225 pounds. During the six following years, the patrolman was told repeatedly to conform his weight to departmental requirements. Finally, he was given five months to lose 43 pounds, or have his employment terminated. When he failed to lose the weight, he was fired although he was informed that he would be eligible for reinstatement if he lost enough weight to comply with the Patrol's rules. The Arizona Supreme Court upheld the dismissal for willful disobedience and insubordination, finding the Highway Patrol's actions to be within the bounds of due process. The Court further found that, in light of the repeated warnings to the patrolman that he reduce weight to the stated requirements, the Highway Patrol had not waived the weight requirements by hiring the overweight officer.

In the Matter of the Town of Orange and International Brotherhood of Police Officers, Local 349 (Case No. 7374-A-92, Conn. Bd. of Med. and Arb. 1974), an officer on the Town of Orange, Connecticut, Police Department, was ordered to lose 6 percent of his weight within 30 days or be subject to disciplinary action. When the officer not only failed to lose the weight, but instead gained twelve pounds, he was suspended without pay for 30 days. The officer thereafter complained that the suspension was unlawful, and in response, the department maintained that the action was justified in view of the fact that the officer's weight made him a prime candidate for cardiovascular failure, and that the Department would be bound under a town ordinance to provide disability benefits to the officer should he suffer from a heart attack or hypertension while on the force. The Board of Mediation and Arbitration which heard the case upheld the suspension, but its order was modified when the officer entered the hospital for treatment.

The San Francisco Retirement Board, in Smith v. San Francisco Police Department, 33 A.E.L.E. Pub. 5 (Sept. 1975), decided a controversy centering around an officer's entitlement to retirement benefits after the Police Department had requested his resignation due to his excessive weight. The 300-pound patrolman contended that his condition was a job-related disability and should be equated with alcoholism. He claimed that the stress of police employment duties drove him to eat. Based on the testimony of the officer's physician, the Retirement Board accepted the officer's theory and granted him benefits amounting to 50 percent of his salary at the time of his retirement.

In the past, it was also common for departments to exclude persons considered to be underweight from the force by setting a minimum weight requirement at the hiring stage. These requirements have been challenged as being discriminatory on the basis of sex. Although the Supreme Court has not spoken on the issue, the U.S. Court of Appeals decision in Smith v. Troyer, 520 F.2d 497 (6th Cir 1975), struck down one such provision. In that case, a woman applicant to the East Cleveland Police Department demonstrated that the weight requirement disqualified 80 percent of the women applicants, whereas only 26 percent of the men applicants were thereby excluded. The court concluded that there was "no rational support for the weight requirement" and that based upon the testimony of even the police department's expert witness, "the weight requirement is neither rationally related to physical strength nor to psychological advantage."

Questions concerning physical agility standards have most often arisen in the context of allegations of discrimination in hiring. There have been two major cases in this area, one in Boston, Massachusetts, and the other in northern California.

In Castro v. Beecher, 334 F. Supp. 930 (D. Mass. 1971), aff'd in part, reversed in part, 459 F.2d 725 (1st Cir. 1972), a number of challenges based on the 1871 Civil Rights Act, 42 U.S.C. 1983, were made to the recruitment and hiring practices of the Boston Police Department. In part, the complaint protested a mandatory 100-yard swim test which all applicants to the force were required to take and pass because a substantially greater proportion of blacks consistently failed the test. The trial court, however, sustained the department's use of the swim test as being reasonably related to fitness and ability to perform in certain rescue situations. In the court's words, "It takes no remarkable powers of imagination to foresee the justified outcry there would be if a child drowned in a lake while a policeman stood by without making even an effort at rescue and gave as his excuse that he could not swim." The court continued that such a test was reasonable even in a community with little water, where there had been no known incidents in which a police officer had been called upon to make a rescue in the water, and in spite of the fact that ability to swim 100 yards may give no indication of life saving ability. The court was likewise unpersuaded by the test's alleged effect on minorities and the absence of test validation. On appeal, the Circuit Court affirmed this part of the trial court's decision, briefly stating that the plaintiffs had failed to demonstrate that the swimming test had any discriminatory impact.

In Officers for Justice v. Civil Service Commission, San Francisco, 395 F. Supp. 378 (N.D. Calif. 1975), women applicants to the police department objected to the use of physical agility tests in hiring. The results of these testing procedures were shown to have a significant adverse impact, that is, excluding a disproportionate number of members of racially, sexually or ethnically defined groups, in this case, women applicants to the force. In the court's opinion, such tests could be utilized only upon a showing that the skills tested are necessary to proper job performance and that no acceptable alternative means could accomplish the same purpose with lesser adverse impact. Because the Civil Service Commission was unable to establish that the skills tested were essential to job performance or that the tests could actually be useful in predicting job performance, the court ruled for the plaintiffs. It then approved the implementation of an experimental program placing sixty women on the patrol force, from which proper studies could be made.

In addition, the court held that women, as members of a group that had been discriminated against in the past, could not be required to pass a physical agility test more demanding than that given to male officers already serving on the force.

Veterans

Several states have laws granting veterans a preference in hiring and promotion for all public employment, for example, South Dakota, S.D. Compiled Laws Ann. §§3-3-1—3-3-6 and Massachusetts Mass. Gen. Laws Ann., Title 32, §85 (West). According to these statutory provisions, veterans who apply are not to be disqualified by virtue of age, loss of limb, or other physical impairment which does not in fact incapacitate them, provided they meet other hiring or promotional qualifications. It is unclear how these provisions stand with respect to standards relating solely to police employment practices as no case has been reported in which the issue arose.

Handicapped

State legislatures have been somewhat more active in their attempts to protect the working rights of their handicapped citizens. The term "physically handicapped" used in the 26 state statutes which prohibit employment discrimination against the physically handicapped, has been defined to include not only disabilities such as blindness and loss of limb, but also diseases such as epilepsy, asthma, and diabetes. A Wisconsin court, in *Milwaukee Railroad v. Wisconsin D.I.L.H.R.*, 215 N.W.2d 443 (Wis. 1974), held that the Wisconsin statute is also intended to cover those who in the past have suffered, but have later recovered, from some disability.

The underlying principle supporting these statutes is that a person is entitled to be judged as an employee on an individual basis and not to be discounted solely because an employer presumes that a person's physical handicap renders him unfit for the position for which he is applying. A New York case, *Bevan v. New York State Teacher's Retirement System*, 345 N.Y.S.2d 921 (N.Y. Sup. Ct. 1973), *aff'd as modified*, 355 N.Y.S. 2d 185 (N.Y. App. Div. 1974), illuminates this principle by holding that it is impermissable to summarily exclude every applicant afflicted with an impairment even though it is generally and validly predicted that many, or even most, persons suffering from that impairment may not be able to perform on the job.

There are, however, limits on how far an employer must bend to avoid discriminating against the handicapped, particularly in fields of employment where exposure to physical hazards is highly likely. Hence, in determining fitness for employment, an employer may consider not only present ability to perform, but the likelihood of an employee's future physical deterioration. It is also proper to take into account the degree of risk encountered in the job and the possibility that the safety of others may be endangered. Therefore, in employment which places a relatively greater amount of stress on a person's body compared to other lines of work, freedom from certain physical handicaps may constitute a bona fide occupational qualification, by reason of which an applicant may be validly denied employment, as was held in the Washington case of Clark v. Chicago, Milwaukee, St. Paul and Pacific Railroad (Wash. Super. Ct., Oct. 3, 1975).

On the National level, Section 503 of the Vocational Rehabilitation and Other Rehabilitation Services Act, 29 U.S.C. §793, passed by Congress in 1973 prohibits employment discrimination against the physically and mentally handicapped by any employer receiving federal financial assistance. As in comparable state laws, the term "handicapped" as used in the federal legislation is to be given a broad interpretation. In addition, the question of whether a particular disability qualifies as a handicap under the Act is to be determined on a subjective basis, that is, on whether the particular disability constitutes a handicap for employment purposes for the individual affected by it, 29 U.S.C.A. §706(6) (1975).

Alcoholism

The effects of alcoholism can be such a grave problem for police departments that most departments specifically make drinking or intoxication while on duty grounds for disciplinary action. Because the effects of alcoholism on performance of duty are usually dealt with in terms of an officer's mental capacity to carry out his responsibilities, the physical condition of an alcoholic officer may come up only in the context of disability benefits. Some state laws specifically exclude alcoholism from the range of disabilities for which an employee may obtain benefits, as in Georgia, Ga. Code Ann. §78-911; a similar Florida statute was upheld in Steigerwalt v. St. Petersburg, 316 So.2d. 554 (Fla. 1975).

As was the case with overweight officers, issues arising from problems of alcoholism may not be directly related to performing law enforcement tasks, but may be more closely associated with internal department discipline. For example, an officer of the Flint, Michigan, Police Department was dismissed for tardiness, absenteeism, and abuse of sick leave. The arbitrator, in City of Flint and Flint Police Patrolmen's Ass'n., Arbitrator's Award (Public Safety Labor Reporter, Employment Practices 4-31 (Sept. 1975)), determined that the officer was in fact suffering from an illness, alcoholism, and that like anyone else having any other illness, was entitled to obtain treatment. The officer was thereupon reinstated to the force on the condition that he remain sober and continue in the rehabilitation program he had entered following his discharge.

Pregnancy

There are presently no cases reported concerning pregnant police officers, but brief overview of the law as it relates to other public service employment requiring some minimum level of physical competence gives some hints about how the courts would deal with the issue. The Supreme Court in La Fleur v. Cleveland Board of Education, 414 U.S. 632 (1974), decided that it is unconstitutional for an employer to require that all pregnant women take leave beginning in their sixth (or fourth or eighth) month of pregnancy. That case, however, did not involve a situation in which employees constantly encountered physical stress. Note 13 to the decision in the La Fleur case, and Newmon v. Delta Airlines, Inc., 374 F. Supp. 238 (N.D. Ga. 1973), indicate that mandatory leave policies could be more strict if competent medical evidence showed that continuation on the job after a certain stage of pregnancy would greatly increase the risk of injury. In any event, the Supreme Court suggested in La Fleur, at Note 14, that an employer can require some evidence of a woman's continued capacity to perform her duties fully and may even require her to submit to an examination by a physician of the employer's choice.

Promotion

Just as all departments require a certain minimum physical capacity of applicants to the police force, a number of jurisdictions also demand that some physical fitness standards be met before an officer can be promoted. Generally, this involves a physical examination and certification of fitness by the department physician, for example in Texas, Tex. Civ. Stats., Title 28, Art 1269m. and Missouri, Mo. Ann. Stats. §84-590 (Vernon). The legislature in

Indiana, Ind. Code §§19-1-7-2, -3, has established a promotion board which is to maintain records of, inter alia, the physical qualifications of officers. Persons applying for promotion must attend special promotion schools for at least two weeks where they are to receive instruction, as well as submit to mental and physical tests and participate in competitive examinations.

Like entrance requirements, promotion requirements have sometimes been challenged as being discriminatory. The validity of these requirements depends upon whether they are reasonable in relation to the goal of assuring that only physically capable officers will be serving on patrol. For example, in an action by a woman police officer who was denied promotion to sergeant for failure to meet the department's promotional standards relating to height, weight, strength, agility, and patrol experience, a Federal Court, in Hail v. White (N.D. Calif. 1973) upheld the requirements. When the plaintiff was hired, entrance requirements were lower for women than for men, but women could not be assigned patrol duties and therefore could not be promoted. After the plaintiff filed suit, the department opened up the patrol classification to women as well as men and established new across-the-board standards for hiring and promotion. The plaintiff was unable to meet the uniform standards for height and weight and was therefore not qualified to take the physical agility tests. The court determined that the height and weight requirements were substantially related to job performance because they assured physical equivalence with control situations. Further, the court concluded that while better strength and agility tests could be devised, the ones being used were substantially related to job performance. Note that similar standards, used as entrance requirements were struck down in Officers for Justice v. Civil Service Commission, San Francisco, supra.

Medical Examinations

To insure the physical competence of their law enforcement officers, many jurisdictions require applicants and/or in-service patrol officers to submit to periodic medical examinations conducted by physicians hired or appointed by the state or municipality. In some cases, physical exams will be required only when there is a question of disability or when promotion is sought, but in other instances, the department may order physical examinations on a yearly basis or at its discretion. Examples of such statutes are those in Ohio, Ohio Rev. Code Ann. §143.31, Nevada, Nev. Rev. Stat. §614.457, and Arizona, Ariz. Rev. Stat. §9-932. Challenges to this authority have generally been unsuccessful. For example, the New Mexico statute, N.M. Stat. Ann. §30-2-6, provides that, in order to qualify as a member of the State Police, one must successfully pass any physical examination that "the Police Board may require." A New Mexico court held in Tafoya v. New Mexico State Police Board, 81 N.M. 710, 472 P.2d 973 (1970), that this standard is a continuing requirement and not solely a requisite for new entrants. Police officers attempted to invalidate a similar law by contending in City of Sharon v. Rose of Sharon Lodge No. 3, 315 A.2d 355 (Pa. Cmwlth. 1973) that the ordinance requiring police officers to take an annual physical as a condition of continued employment was unjustifiable in light of a statute granting police officers the right to bargain in matters concerning terms and conditions of employment. The court held that the medical exam was not a "condition of employment" in the context of the collective bargaining statute. It then declared the ordinance to be reasonable, emphasizing its belief that an officer's physical fitness is absolutely essential to the performance of law enforcement duties.

Disability

When a law enforcement officer becomes physically unfit for duty, a number of difficult questions arise. Who is to determine his fitness or unfitness? Can he be discharged or involuntarily retired? Is he entitled to a hearing? Is he entitled to a pension?

Physical incompetence is widely regarded as adequate ground for dismissal, although very few statutes expressly declare that physical ailments, defects, or diseases which undermine the officer's ability to fully perform his duties may be grounds for discharge, suspension, or demotion. Actions to remove an officer for physical inability to perform his duties generally follow standard disciplinary procedures; however, it should be recognized that such removals are not necessarily based on findings of intentional misconduct.

The case of O'Neil v. City and County of San Francisco, 77 Cal. Rptr. 855 (1969), illustrates the point. In that case, an officer with four years of service began to suffer from grand mal epileptic seizures. The officer was given notice of a possible discharge after his refusal to submit his resignation. For lack of a better regulation under which to proceed, the department charged that the officer, by reason of his physical disability, was incapable of performing police functions and sought a "dismissal for cause" under the city and county charter; the department did not allege any misconduct per se. The officer was given a full and fair hearing, after which he was discharged. The court upheld the removal on appeal, stating that the department was not obliged to show that the officer was at fault before being authorized to dismiss him for cause, but that proof of physical incapacity was sufficient.

Once it has been determined that physical incapacity may be grounds for dismissal, the question then arises as to whether it may be accomplished summarily or whether certain procedural safeguards, such as notice and a hearing, are required. A department's authority to discharge an employee summarily for physical disability may rest primarily on whether the employee has passed the probationary period of employment. In Illinois, where a probationary officer was certified by the Civil Service Commission as being in good health, but was subsequently suspended and discharged without a hearing when a second physical examination produced evidence of a tubercular disability, the court, in People ex rel. Ballinger v. O'Connor, 13 Ill. App. 2d 317, 142 N.E. 2d 144 (1957), held that the police commissioner had the power to summarily discharge an officer. In another situation, an officer was injured in an off-duty accident in the eleventh month of his twelve month probationary period. When he sought to return to work four months later his request was denied without a hearing. The Police Commission claimed that the psychological impact of the accident on the officer would affect his performance and that the potential aggravation of the officer's injury in the performance of police functions might be financially detrimental to the city, since the city might then be bound to award disability benefits. The court, in Clark v. City of Manchester, 305 A. 2d 666 (N.H. 1973), found that although the officer was indisputably a credit to the force, an injury made it impossible for him to complete his twelve-month probationary period satisfactorily, and that the Police Commission therefore had authority to terminate his employment without a hearing.

Different procedural rules apply when the officer has nonprobationary status. In Tafoya v. New Mexico State Police Board, supra, the police captain involved failed to pass a required physical exam, and his employment was terminated without notice or hearing. In that case, the court said that the termination amounted to a dismissal for incompetence, which requires notice and hearing under New Mexico statutes and due process standards.

An ever-increasing number of legislatures are making disability benefits available to police officers who suffer from heart disease, hypertension or lung ailments incurred in the course of employment. These provisions are discussed generally in 1A Larson, Workman's Compensation Law §41.70, at 8-301 - 8-311 (1973 & Supp. 1977). Therein it is pointed out, that when the statute provides that a presumption arises that an officer's heart or lung ailment is connected with the exertions of employment, that presumption cannot be rebutted by evidence of pre-existing heart disease or an opinion that the occupation had no effect on a weakened heart. Most statutes limit eligibility for such benefits to officers who have served a number of years on the force and have previously been found free of such ailments in a physical exam. The statutes enacted in California, Cal. Labor Code §3212.3 et seq. (West), Minnesota, Minn. Stat. Ann. §176.011 (West), and North Dakota, N.D. Cent. Code 65-01-02, contain provisions establishing the presumption and conditioning its application on length of service and prior physical examinations. Florida, Fla. Stat. Ann. §185.34 (West), requires that electrocardiogram results be presented as evidence of no prior disabling condition. In Nevada, the presumption applies only to lung diseases, Nev. Rev. Stat. §617.455, and considers heart disease to be an occupational disease only if caused by "extreme overexertion in times of stress or danger" and upon a showing of causal relationship between the injury and the alleged source, Nev. Rev. Stat. §617.457. In addition to the five states whose statutes are cited in the discussion above, eight other states—Connecticut, Maryland, Massachusetts, Michigan, Nebraska, Pennsylvania, Tennessee, and Virginia—have statutes which make special provision for compensation of policemen who claim heart or lung disease related disabilities.

Generally, the statutes have been liberally applied in order to implement the legislative intentions. In a case where a disabled officer had taken the prerequisite physical examination twenty two months prior to the date his permanent employment began, a Massachusetts court in Foster v. City of Everett, 133 N.E. 2d 480 (Mass. 1956), determined that he had satisfied the statutory requirement that an officer must pass a medical examination upon "entry" into service before entitlement to the presumption that a heart disease arose in the course of employment. Likewise, in City of Oak Ridge v. Campbell, 511 S.W. 2d 686 (Tenn. 1974), the court held that the presumption that a police officer's heart disease resulted from his occupation under the Tennessee statute, alone was sufficient to meet other statutory requirements that disabilities must arise in the line of duty to be compensible.

The Florida Statute, Fla. Stat. Ann. 185.34 (West), withstood a constitutional attack in City of Coral Gables v. Brasher, 120 So. 2d 5 (Fla. 1960); this case represents the general trend of the holdings. However, a Connecticut court held, in Ducharme v. City of Putnam, 161 Conn. 135, 285 A. 2d 318 (1971), that a statutory presumption that heart disease was a disability arising out of the course of employment was unconstitutional so long as it made the presumption conclusive and precluded the introduction of evidence tending to rebut it.

Retirement

Nearly all jurisdictions make some provision for the retirement of officers disabled while serving on the police force. Often these statutes make distinctions between officers disabled in the line of duty and those disabled outside the line of duty, and between officers who have served some minimum number of years on the force and those who have not. Thus, an officer who has been employed for twenty years may be able to retire by virtue of any certified permanent disability, whereas an officer having fewer years of service may be eligible for retirement only upon proof that the disability was incurred in the performance of his duties. Statutes which illustrate these various provisions have been enacted in Connecticut, Conn. Gen. Stats. Ann. §7-297; Louisiana, La. Rev. Stats. Ann. §§2234, 2294; Arkansas, Ark. Stats. Ann. §19-1809; and Arizona, Ariz. Rev. Stats. §§9-925, 9-926, 9-932.

Most often, the conflicts that arise under these provisions involve factual disputes over the officer's eligibility for benefits under the statute. Occasionally, however, a department will seek to retire an officer with full benefits, but against the officer's will. In those cases, it is incumbent upon the department to show that the officer has been disabled. A case in point is City of Hagerstown v. Blenard, 302 A.2d 53 (Md. 1973), in which a police captain with thirty years of service was "retired" by the mayor without a hearing or any explanation. The court observed that two County Code provisions might be applicable: one provision permitted discharge of an officer after appropriate notice and opportunity to reply; the second gave the mayor the authority to retire an officer having at least fifteen years of service upon certification of two physicians that the officer was permanently disabled. In this case, however, the officer was never given a physical examination; therefore, the court concluded that the mayor's discretion was not so great as to allow him to override the specific mandates of the County Code in using his authority to retire the officer.

As stated, the usual disagreement arises over whether an officer applying for benefits is in fact disabled. To protect police departments from spurious claims, therefore, most statutes require certification of disability from two or more physicians, as in Louisiana, La. Rev. Stats. Ann. §2376, and Kentucky, Ky. Rev. Stats. §95.864. In addition, legislation, such as that in Connecticut, Conn. Gen. Stats. Ann. §7-298, Louisiana, La. Rev. Stats. Ann. §§2294, 2376, and Arkansas, Ark. Stats. Ann. §19-1810, may permit the police department or appropriate board to require additional physical examinations to determine whether the officer is entitled to continued pension benefits or will be reinstated pursuant to a certification of good health. In lieu of full-time reinstatement, legislation in Hawaii, Haw. Rev. Stats. Ann. §88-168, provides that an officer may be ordered to report to duty from time to time to perform duties for which he is fit, even if the responsibilities differ from those previously undertaken. Permanent reassignment was upheld by a Louisiana court in Johnson v. State Dept. of Institutions, 198 So.2d 159 (La. App. 1967); Louisiana also has a statute, La. Rev. Stats. Ann. §2376, which provides that an officer terminated due to incapacity, if able, must engage in gainful employment and deduct his earnings from the disability benefits for which he would otherwise be eligible.

Once again, although it is usually an officer's superiors who seek to initiate reinstatement, there are cases in which the officer himself wants to return to work. The question then becomes, what are his rights to employment vis-a-vis those of the officer hired to replace him? This precise question was addressed by the New Jersey courts in Bouley v. Borough of Bradley Beach, 42 N.J. Super. 159, 126 A. 2d 53 (1956), a case involving an officer who lost his employment after the reinstatement of another member to the force. The reinstated lieutenant previously had voluntarily retired from the department on a disability pension, but was entitled to seek reinstatement upon certification of full recovery, provided a position was then available. The trial court granted summary judgment in favor of the reinstated lieutenant, but this decision was reversed on appeal. The court held that if the department's budget could not accomodate an additional officer, no position was "available" under the statute, and therefore the reinstatement of the retired officer at the expense of one presently serving on the force was improper.

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The laws governing employment related disabilities generally require, in addition to certification of the fact of disability, proof that the disability was proximately caused by some work accident or hazard, as in Massachusetts, Mass. Gen. Laws Ann. Title 32, §85F and Maine, Me. Rev. Stat. Title 25, §1594. A frequent dispute involves whether or not ulcers qualify as a disability under these provisions.

In one recent workmen's compensation case, Oklahoma City v. Schoonover, 535 P.2d 688 (Okla. 1975), the decedent had obtained employment as a police officer upon certification that a prior ulcer had completely healed. A year after the officer's instatement, the ulcer started up again. The condition gradually worsened until finally the officer required surgery, shortly after which he died. Evidence produced at a subsequent hearing satisfied the Workmen's Compensation Board that the officer's disability was caused by the emotional strain of his job. Therefore, it was decided that although the condition was a pre-existing dormant one, it was nonetheless compensable under the Workmen's Compensation Act.

In an earlier case, a Santa Ana police officer developed an ulcer condition after fifteen years on the force. Thereafter, he missed a considerable number of days from work due to illness. During the four years following the inception of the ulcers, the officer twice sought disability benefits, but was turned down on both occasions. Shortly after returning to work after the second denial, the officer was discharged for incompetence, based on a determination that his ulcers rendered him incapable of discharging his duties. The California court in Boyd v. City of Santa Ana, 99 Cal. Rptr. 38, 491 P.2d 830 (1971), held that the department could not refuse to grant the officer disability benefits or a leave of absence from the force for an ulcer condition and then turn around and dismiss him for physical incompetence caused by the same ulcer condition. In the court's opinion, if the department could elect to terminate any officer for disability under a discipline code rather than allow him to terminate voluntarily under the retirement provision, the statutes creating pension rights upon a finding of disability would be mere nullities.

Conclusions

In general, municipal agencies are moving away from absolute qualifications such as minimum weight for entrants to the police force and toward a more balanced testing of individual candidate's ability to perform on the job The primary exception has been age, which until recently has invariably been found to be a rational absolute measure of capacity.

The movement away from absolute entrance qualifications has been accompanied by a trend toward a more intensive in-service review of physical condition. Mandatory medical examinations and continuing training are becoming increasingly common. Moreover, lack of physical competence is generally grounds for discharge, demotion, or retirement, and officers must constantly be prepared to present evidence of their continued fitness for employment. Nonprobationary officers, of course, must be accorded their due process rights in these circumstances, but their performance is nonetheless subject to review.

A final identifiable pattern which goes hand in hand with the more intensive and structured review of in-service performance is the increased attention being given to disability protection. Courts are becoming more reluctant to refuse disability benefits to law enforcement personnel who claim to have been injured in the line of duty. Compensation has been awarded to officers whose injuries have included ulcers, alcoholism, and even obesity. Legislatures have kept pace by enacting statutes which make such impairments as heart disease, lung disease and hypertension presumptively job related or by providing compensation for those disabilities when they are not included in Workmen's Compensation schemes for other occupations. The increased emphasis on equal protection and due process in department-employee relations has genearlly been accompanied by more extensive testing and review procedures. The efforts of the legal system and the law enforcement community should combine to reach the goal of guaranteeing fair employment rights to police officers without detriment to the general welfare and safety of local communities.

CHAPTER 10

MEDICAL SCREENING AND FITNESS EVALUATION

Importance and Need for Medical Screening and Fitness Evaluation

Several reasons exist for evaluating the physical fitness level of police officers before they start an exercise program. The most obvious reason is perhaps explained from a medical safety standpoint and is best summarized by the American College of Sports Medicine:

> For the sedentary individual there is a serious risk in the sudden, unregulated and injudicious use of strenuous exercise. But it is a risk that can be minimized and perhaps even eliminated through proper preliminary testing and the individualized prescribing of exercise programs (1).

The minimization of such risk is achieved in part by undergoing a medical screening examination. Medical screening includes a record of personal health history, family health history, present medication and treatment, diet analysis, smoking history, and physical activity patterns in order to assess the risk of testing and exercising. The procedure identifies past and present health status and determines if a person is a high risk for coronary heart disease (CHD) (22). A high-risk individual is classified as one who is older than 35 years and has a majority of risk factors established by the American Heart Association (2, 12, 13). The risk factors include high blood pressure, elevated blood fats (cholesterol and triglycerides), cigarette smoking, obesity, physical inactivity, elevated blood sugar and uric acid, family history, and excessive emotional stress. Medical screening is an obvious protective practice for both the exercise participant and program director in preventing medical complications and injury during activity. This is particularly important for officers older than 40 years of age since they have been found to be at higher-than-average risk (19). The officers under age 40 appear to be of average risk; however, medical screening is of no less importance with young officers.

In addition to medical screening, fitness evaluation tests are required prior to initiating an exercise program. Fitness evaluation is primarily the assessment of the functional capacity of the body through testing the cardiorespiratory system during exercise stress. The evaluation also includes the determination of body composition, flexibility, muscular strength and endurance, and pulmonary function. The results of the fitness evaluation are used to determine the present medical-health and level of fitness status of the individual police officer and as a basis for exercise prescription. Also, the results are used as a baseline for future comparisons. With respect to this latter statement, physical fitness tests are excellent motivators for individuals in that they provide objective measures of benefits reaped from regular exercise programs.

MEDICAL SCREENING

A thorough and detailed explanation of the medical examination is available in the textbook edited by Larson (16). Generally, the medical examination should include the following:

1. Comprehensive medical history questionnaire covering family health history and current health habits such as smoking, alcohol intake, physical activity, and medications. Special emphasis should be placed on primary risk factors of coronary heart disease (CHD), i.e., high blood pressure, smoking, high blood fat levels (cholesterol and triglycerides), obesity, physical inactivity, and family history of CHD. An example of the questionnaire used by

the Institute of Aerobics Research is presented in Appendix A .

2. The following laboratory tests are recommended if the budget is adequate:

   a. Chest X-ray
   b. Physical inspection of the spine and limbs for bone and joint abnormalities and of the neck, chest, abdomen, eyes, ears, nose, and throat
   c. Auscultation (listening) of heart and lung sounds for identification of possible cardiac murmurs, dysrhythmias, or chronic lung disease
   d. Measurement of resting heart rate, blood pressure, and respiration
   e. Chemical analysis of blood for levels of serum cholesterol, triglycerides, glucose, and uric acid
   f. Resting 12-lead electrocardiogram (EKG)
   g. Exercise stress EKG
   h. Height and weight

3. The following tests are suggested as minimal medical screening devices if the budget is limited:

   a. Physical inspection for limitations and handicaps
   b. Heart rate and blood pressure measurement
   c. Resting 12-lead ECG
   d. Height and weight

GUIDELINES FOR FITNESS TESTING

Informed Consent

An explanation of all tests and exercise procedures to the participant is mandatory before administering a fitness evaluation; the participant must be aware of what is required and potential risks. An informed consent form explains these factors, and a participant must sign this form prior to any testing. An example of an informed consent document is included in Appendix B .

Emergency Procedures

The knowledge of emergency procedures is essential when conducting fitness evaluations. All personnel involved with the program must be informed of such procedures, be trained in cardiopulmonary resuscitation and basic first aid, and be able to determine the severity of the emergency and the appropriate response. All personnel should have assigned duties in an emergency and should practice these duties regularly to insure teamwork and reduce confusion during an actual emergency. The procedures for action during an emergency should be typed and posted and should be continually updated. The most recent information concerning cardiopulmonary resuscitation and first aid procedures should be reviewed frequently with the staff. The equipment on hand for emergencies should include a resuscitator, a defibrillator, and a basic first aid kit. A telephone code system is recommended to expedite communication with the referring physician, hospital, or clinic personnel.

Contraindications to Exercise Testing

Certain absolute conditions exist under which persons should not be exercise stress tested. If through the medical history questionnaire or any other means a non-physician discovers that an officer had any of the conditions listed below, the officer should be referred to a physician:

1. Circulatory insufficiency (congestive heart failure)
2. Myocardial infarction (heart attack)
3. Myocarditis (inflammation of heart muscle)
4. Angina pectoris (chest pain)
5. Pulmonary embolism (blood clot in lungs)
6. Aneurysm (weak spot in wall of artery or heart)
7. Infectious disease
8. Vein inflammation
9. Heart arrhythmias
10. Heart valve disease

Other relative conditions exist under which persons may be tested with certain precautions. These conditions are listed and discussed elsewhere (1). In general, officers with a questionable medical history and/or medical problem also should be referred to a physician prior to beginning an exercise program. The same procedure should be followed for persons over 35 years of age and those under 35 who are considered a high risk for CHD.

Types of Tests

The types of tests given in a fitness evaluation depend on four major factors:

1. Time - If large numbers of officers must be tested in a short period of time, the tests are limited to the field type. If adequate time is available, then more sophisticated laboratory tests can be administered.

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2. Funds - The equipment required in laboratory testing is usually complex and expensive. Therefore, only a limited amount of equipment is usually available.

3. Personnel - Ideally, only qualified individuals trained in exercise testing such as physical educators and exercise physiologists should administer laboratory stress tests. However, certain field tests can be administered by police personnel if the exercise participants are low risk and under the age of 35.

4. Population - Young officers under the age of 35 are generally healthy and may be tested in a variety of ways with low risk. Caution must be emphasized with persons over age 35 or participants found to be high risk through medical screening.

The major categories of fitness evaluations described in this chapter include the following:

1. Cardiovascular - Respiratory
    a. Resting
        (1) heart rate (sitting)
        (2) blood pressure (sitting)
        (3) 12-lead electrocardiogram
    b. Submaximal - three minute step test
    c. Maximal stress test
        (1) oxygen intake
        (2) treadmill time
        (3) electrocardiogram
        (4) heart rate

2. Pulmonary Function (spirometry)
    a. Vital capacity
    b. Forced expiratory volume for one second
3. Body Composition
    a. Height and weight
    b. Skinfold fat
    c. Percent body fat
    d. Lean body weight
    e. Girth measures
4. Blood (serum)
    a. Cholesterol
    b. Triglycerides
    c. Glucose
    d. Uric Acid
5. Motor Ability
    a. Flexibility
    b. Muscular strength
    c. Muscular endurance
    d. Power
    e. Agility

Some of the fitness tests such as resting heart rate, resting blood pressure, 12-lead EKG, stress EKG, height, weight and blood analysis are also included within the medical screening. The following descriptions of the physical fitness tests are divided into laboratory and field procedures for the purpose of providing moderate to high- and low-budget recommendations.

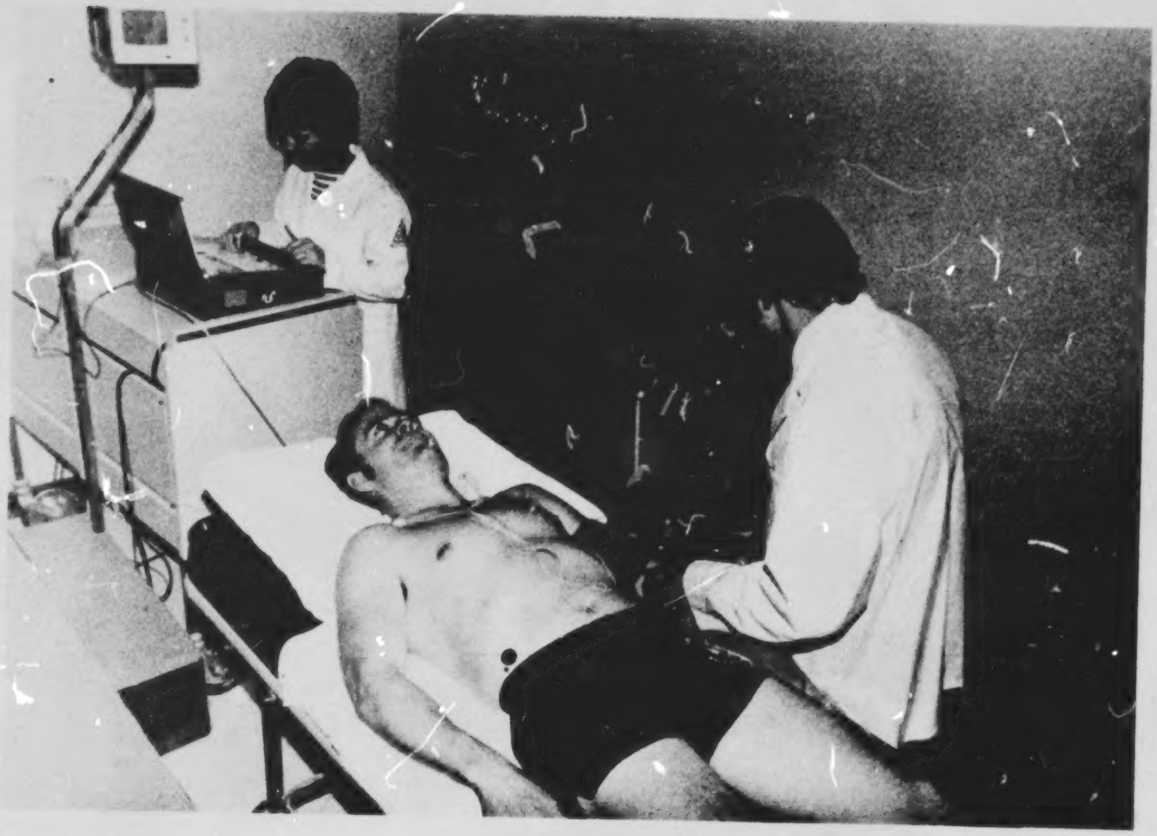
LABORATORY PROCEDURES

Cardiovascular-Respiratory Tests

The required procedures before administering a maximum cardiovascular-respiratory (CR) stress test involve the monitoring of resting electrocardiogram, heart rate, and blood pressure. The equipment for such procedures includes an electrocardiogram recorder with patient cables, a stethoscope, sphygnomanometer (blood pressure recorder), stretcher bed, and arm chair. Resting measurements including a standard 12-lead electrocardiogram, heart rate, and blood pressure should be made in the supine, standing, and sitting positions before giving an exercise test. The monitoring of such tests is illustrated in Photographs 1 and 2. Norms for resting heart rate and blood pressure measured 10 minutes after being seated in a quiet room are presented in Tables 10.1 and 10.2, respectively.

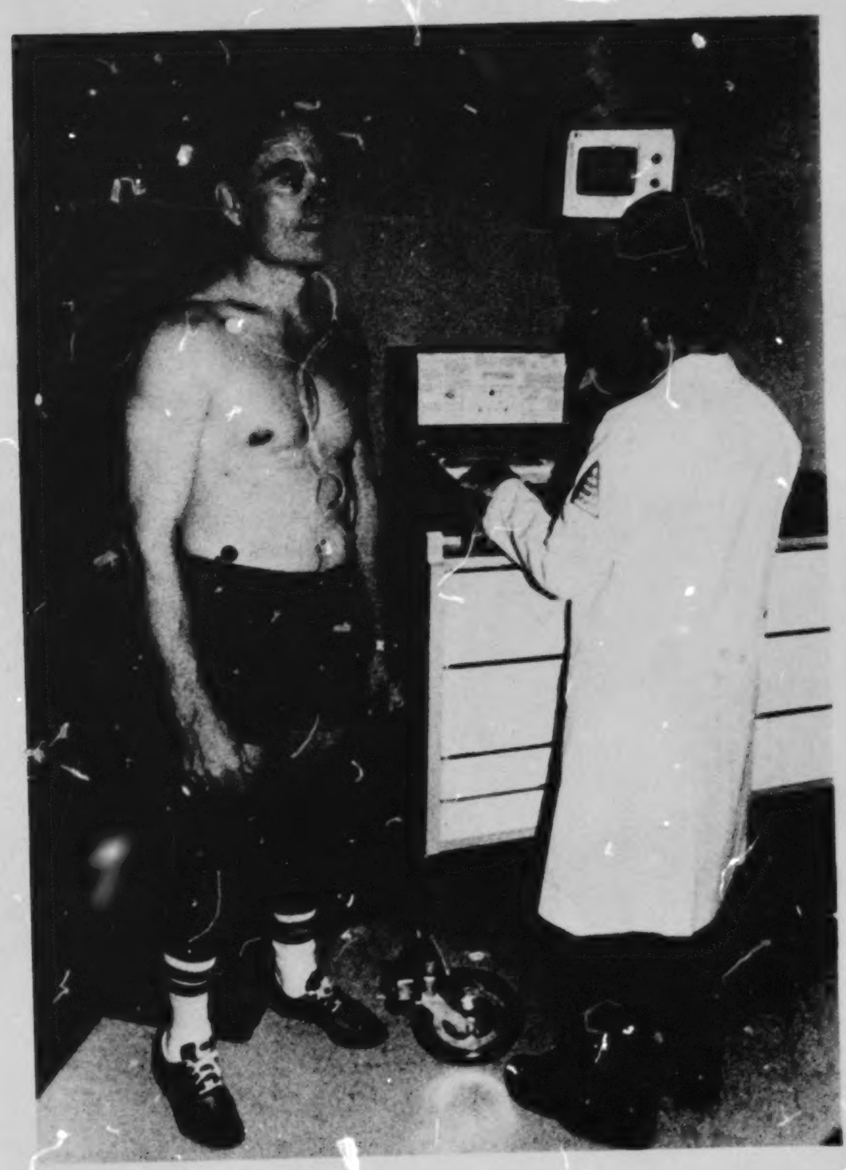
The exercise stress test follows the resting measures,and special reference is made to the publication (1) by the American College of Sports Medicine (ACSM) for guidelines on graded exercise stress testing. The exercise test may employ treadmill (high expense), bicycle ergometer (medium expense), or bench stepping (low cost) procedures. For low risk officers under age 35, the 1.5 mile field test may be used as the CR stress test; however, for individuals over 35 and/or high risk, the laboratory tests are recommended. The laboratory CR test should be a maximal test of a graded, multistage design; i.e., the test should start at a low level of intensity and progress gradually to high levels of intensity until the participant reaches a voluntary maximal endpoint. The electrocardiogram, heart rate, and blood pressure must be monitored throughout the exercise test (see Photograph 3) and during a recovery period of at least

Photograph #1



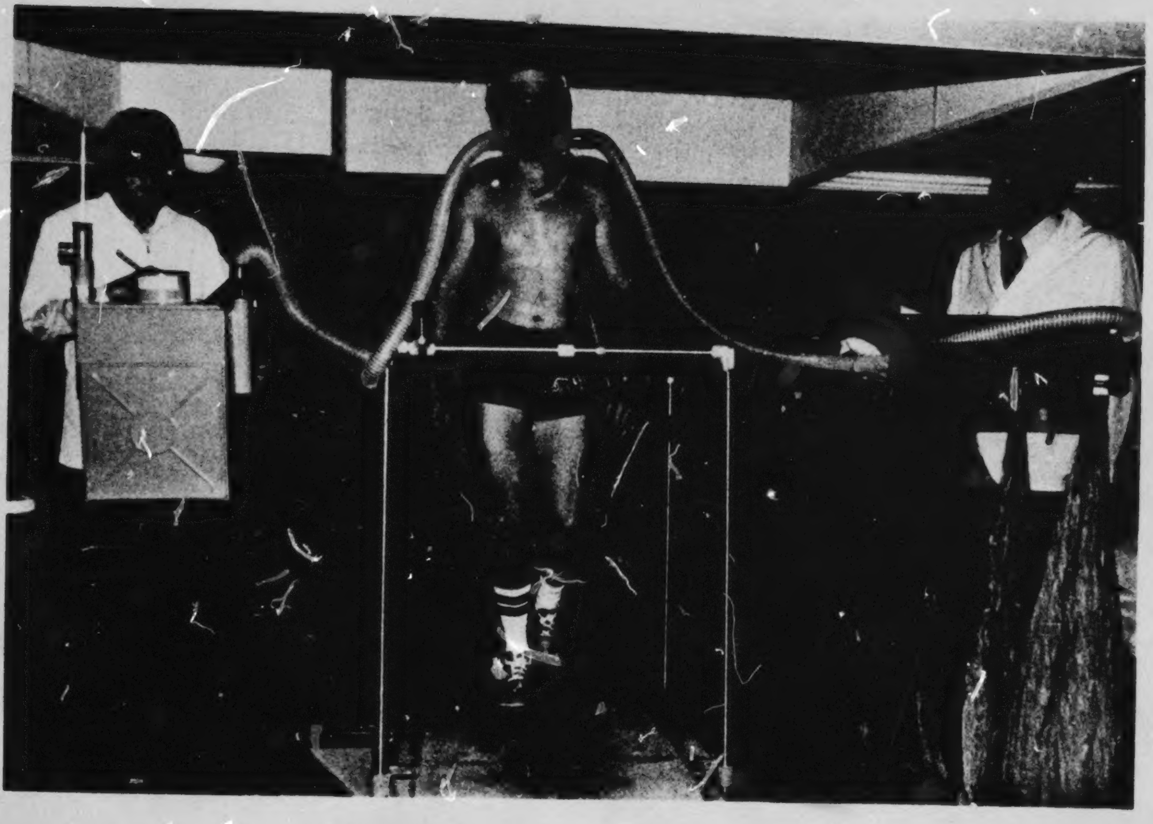
Monitoring Blood Pressure
and Heart Rate, Supine Position

Photograph #2



Monitoring Heart Rate,
Standing Position

Photograph #3



Equipment Used During
VO_2 Max Test

Table 10.1 Police officer standards for resting heart rate*

Fitness Category	Age Groups		
	20-29 yrs (n=88) Heart Rate (beats/min)	30-39 yrs (n=85) Heart Rate (beats/min)	40-52 yrs (n=30) Heart Rate (beats/min)
Excellent	44 and below	44 and below	48 and below
Good	45 to 58	45 to 61	49 to 62
Average	59 to 66	62 to 69	63 to 69
Below Average	67 to 69	70 to 85	70 to 83
Poor	80 and above	86 and above	84 and above

* Measured 10 minutes after being seated in a quiet room.

Table 10.2 Police officer standards for resting blood pressure*

Fitness Category	Age Groups					
	20-29 yrs (n=88)		30-39 yrs (n=85)		40-52 yrs (n=30)	
	Systolic BP (mmHg)	Diastolic BP (mmHg)	Systolic BP (mmHg)	Diastolic BP (mmHg)	Systolic BP (mmHg)	Diastolic BP (mmHg)
Excellent	105 and below	67 and below	98 and below	63 and below	101 and below	69 and below
Good	106 to 118	68 to 78	99 to 116	64 to 78	102 to 117	70 to 81
Average	119 to 124	79 to 83	117 to 125	79 to 86	118 to 124	82 to 87
Below Average	125 to 137	84 to 94	126 to 143	87 to 100	125 to 140	88 to 99
Poor	138 and above	95 and above	144 and above	101 and above	141 and above	100 and above

Measured 10 minutes after being seated in a quiet room.

five minutes following the exercise. The test is continued until the individual reaches a voluntary maximal endpoint or until contraindications dictate that he stop. Those contraindications are the following (1):

1. Dizziness
2. Chest pain
3. Intolerable fatigue or pain
4. Mental confusion
5. Pallor
6. Distressful breathing
7. Nausea
8. Definite fall in systolic blood pressure
9. EKG changes:
    a. S-T segment depression
    b. Arrhythmias

The most popular stress tests involve walking and/or running on a motorized treadmill. The treadmill is preferred because walking and running are familiar activities and minimal time is required to adjust to the treadmill. Cycling and climbing stairs (bench stepping), strangely enough, are unfamiliar activities to Americans, and local pain in the leg muscles often causes a participant to stop prematurely.

A recommended procedure for treadmill stress testing is the Bruce protocol (6). The protocol is presented in Figure 10.1 and involves starting at a low level of intensity (1.7 mph and 10 percent grade) and gradually progressing in speed and grade every three minutes. When large numbers of officers are to be tested, this protocol is quite practical because it is a short efficient test. This

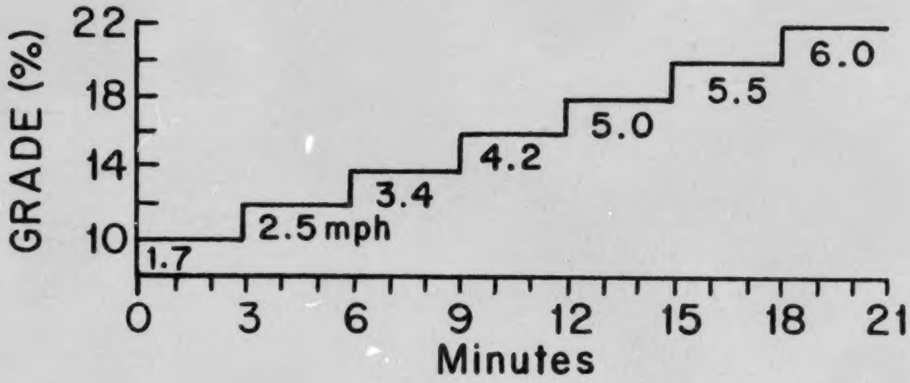


Figure 10.1 The Bruce protocol for treadmill stress testing (6)

test also can be used as a timed performance test and has a good relationship with maximum oxygen intake (VO_2 max).

An optional, but important, evaluation of CR function is the measurement of VO_2 max or aerobic capacity. Optimal fitness ultimately depends on the ability of the body to take in, transport, deliver, and use oxygen. This ability obviously involves the lungs, blood, heart, and the muscles performing the work. The VO_2 max test is sophisticated and requires complex equipment (see Photograph 3), but is recommended if budgets are adequate and qualified personnel are available to conduct the test. Astrand and Rodahl (3) and Consolazio _et al_. (8) have explained in detail the principles of measuring oxygen intake.

Maximum oxygen intake can be measured during the Bruce protocol described previously, or, from a practical standpoint, can be _estimated_ from the performance time on the Bruce treadmill test as shown in Table 10.3. Results from the study conducted on police officers are presented by age decades. For example, if an officer 32 years of age continued for 10:37 on the Bruce test his predicted VO_2 max would be 40.2 ml/kg·min and this would place him in the "good" fitness category for his age group. Other and more practical tests like the step test, 1.5-mile run, and 12-minute run also can be used to predict maximum oxygen intake. Thus, the Bruce test and other similar tests can be used as an electrocardiogram stress test, a physical performance time test, and a measure of functional capacity (maximum oxygen intake prediction).

Submaximal Cardiovascular-Respiratory Tests

Less sophisticated than treadmill stress tests, but still valuable as CR

Table 10.3 Estimation of maximum oxygen intake (VO_2 max) fitness classifications from Bruce treadmill performance test (6).

Fitness	Age Groups					
	20-29 yrs (n=88)		30-39 yrs (n=85)		40-52 yrs (n=47)	
	Treadmill Time (min:sec)	VO_2 max (ml/kg·min)	Treadmill Time (min:sec)	VO_2 max (ml/kg·min)	Treadmill Time (min:sec)	VO_2 max (ml/kg·min)
Excellent	13:12 & above	52.9 & above	12:22 & above	47.4 & above	11:02 & above	40.1 & above
Good	11:24 to 13:11	44.8 to 52.8	10:37 to 12:21	40.2 to 47.3	9.34 to 11:01	34.3 to 40.0
Average	10:30 to 11:23	40.8 to 44.7	9:44 to 10:36	36.6 to 40.1	8:49 to 9:33	31.4 to 34.2
Below Average	8:42 to 10:29	32.8 to 40.7	7:59 to 9:43	29.3 to 36.5	7:21 to 8:48	25.6 to 31.3
Poor	8:41 & below	32.7 & below	7:58 & below	29.2 & below	7:20 & below	25.5 & below

Function tests, are the submaximal bicycle ergometer and bench step protocols. The purpose of the submaximal work capacity test on the bicycle ergometer is to assess the response of the heart to different workloads. Heart rate is measured at two or three different workloads, and the amount of work that an individual is capable of doing at heart rates of 150 and 170 beats per minute are determined. This physical work capacity (PWC) test is described by Ribisl (21) and is called the PWC-150 or PWC-170. In addition to assessing physical working capacity, the bicycle test also can be used to predict maximum oxygen intake as explained by Astrand and Rodahl (3). The advantages of this test are that equipment needs are minimal (bicycle ergometer, metronome, timer, and stethoscope), the equipment is inexpensive and portable, and the protocol is easy to administer. If possible, this test should also be EKG and blood pressure monitored.

Bench Step Protocol

Low budgets in many cases will prohibit the purchase of treadmills and bicycle ergometers. In these instances, CR function can be assessed by using a very practical, low-cost step test protocol. Kasch and Boyer (14) have developed a three-minute step test that requires the following minimum equipment:

1. A 12-inch bench for stepping
2. Clock with sweep second hand or stopwatch for timing test and counting heart rate
3. A metronome to help subject maintain cadence in proper stepping rate
4. Stethoscope to count heart rate during recover period

The purpose of the step test is to measure the heart rate in the recovery period following three minutes of stepping; the results can be used to estimate maximum oxygen intake as shown in Table 10.4. The rate of stepping is 24 steps

Table 10.4 Estimation of maximum oxygen intake (VO_2 max) fitness classifications from Kasch and Boyer's three minute step test (14).

Fitness	Age Groups					
	20-29 yrs (n=87)		30-39 yrs (n=85)		40-52 yrs (n=29)	
	Step Test HR (beats/min)	VO_2 max (ml/kg·min)	Step Test HR (beats/min)	VO_2 max (ml/kg·min)	Step Test HR (beats/min)	VO_2 max (ml/kg·min)
xcellent	69 & below	52.9 & above	73 & below	47.4 & above	71 & below	40.1 & above
ood	97 to 70	44.8 to 52.8	102 to 74	40.2 to 47.3	103 to 72	34.3 to 40.0
verage	111 to 98	40.8 to 44.7	117 to 103	36.6 to 40.1	117 to 102	31.4 to 34.2
elow Average	139 to 112	32.8 to 40.7	147 to 118	29.3 to 36.5	148 to 118	25.6 to 31.3
oor	140 & above	32.7 & below	148 & above	29.2 & below	149 & above	25.5 & below

per minute. Immediately after the three minutes of stepping, the officer sits down. A 60-second heart rate starting five seconds after the completion of stepping is counted. The average heart rate ranges for the different age groups of police officers are shown in Table 10.4. For an officer 32 years of age with a step test heart rate of 102 beats/min, the VO_2 max prediction would be 40.2 ml/kg·min which would classify the officer in the "good" fitness category. Although the step test is easy to administer and results are easily obtained, its estimation of VO_2 max is less accurate when compared to other exercise tests such as the bicycle and treadmill tests.

Sharkey (23) has developed a five-minute step test to estimate maximum oxygen intake and, therefore, to assess fitness and physical working capacity. Recovery heart rate is counted for 15 seconds after the step test and a calculator chart is used to determine the fitness score. The calculator chart is very convenient to use, and, in fact, is designed so that an individual may administer and score the test himself. The calculator chart is available through the U.S. Department of Agriculture: Forest Service.

Pulmonary Function Tests

Basic lung function and capacity are assessed by measures of vital capacity (VC) and forced expiratory volume for one second (FEV_1). Spirometry equipment of medium expense is needed for such assessment, and procedures outlined by W.E. Collins, Inc. (7) and Kory et al. (15) a recommended. Norms by decade for VC and FEV_1 are presented in Table 10.5. Vital capacity is related to body size; therefore, lung function is evaluated with more emphasis on FEV_1 (%). For example, a relatively small 32-year-old officer may have a small vital capacity

Table 10.5 Police officer standards for pulmonary function tests.

Fitness ategory	Age Groups								
	20-29 yrs (n=89)			30-39 yrs (n=85)			40-52 yrs (n=29)		
	Vital Capacity (L)	FEV$_1$* (L)	FEV ÷ VC** (%)	Vital Capacity (L)	FEV$_1$ (L)	FEV ÷ VC (%)	Vital Capacity (L)	FEV$_1$ (L)	FEV ÷ VC (%)
xcellent	7.69 and above	6.58 and above	86 and above	7.32 and above	6.13 and above	84 and above	6.29 and above	5.03 and above	80 and above
ood	6.26 to 7.68	5.06 to 6.57	81 to 85	5.87 to 7.31	4.74 to 6.12	81 to 83	5.26 to 6.28	4.09 to 5.02	78 to 79
verage	5.55 to 6.25	4.31 to 5.05	78 to 80	5.14 to 5.86	4.05 to 4.73	79 to 80	4.75 to 5.25	3.62 to 4.08	76 to 77
elow verage	4.13 to 5.54	2.80 to 4.30	68 to 77	3.68 to 5.13	2.66 to 4.04	72 to 78	3.72 to 4.74	2.69 to 3.61	72 to 75
oor	4.12 and below	2.79 and below	67 and below	3.67 and below	2.65 and below	71 and below	3.71 and below	2.68 and below	71 and below

FEV$_1$ (L) = liters of forced expiratory volume for one second.

FEV$_1$ ÷ VC (%) = percentage of FEV$_1$ to vital capacity IVC).

of 3.5 liters yet have a "good" rating of 83% for FEV_1 (%). Care must be taken when using these pulmonary measures as fitness tests.

Blood

If feasible, it is desirable to obtain a 15 ml blood sample from the antecubital vein for analysis of serum lipids (cholesterol and triglycerides), glucose, and uric acid. The sample should be drawn after a standard 14 hour fast during which no food is allowed except water. These variables have been related both to levels of fitness and coronary heart disease risk (10). Norms for police officers are presented in Table 10.6. Unless a department already has the blood analysis equipment or is large enough to make the cost feasible, it is recommended that the blood be analyzed at a local medical laboratory.

Field Test Procedures

Cardiovascular-Respiratory Tests

The best field tests of CR function are the 1.5-mile and 12-minute run tests described by Cooper (9). The time required to run 1.5 miles or the distance covered in 12 minutes is recorded in the tests and then evaluated using Table 10.7. In addition, VO_2 max can be predicted from the test results. For example, a 32-year-old officer who runs the 1.5 mile test in 11:01 or 1.64 miles in the 12-minute test would have a predicted VO_2 max of 48.0 ml/kg·min and would be classified in the "good" fitness category. Advantages of these field tests are that large groups of officers can be tested in a short period of time and the tests are highly correlated with aerobic capacity (9). The disadvantage is that a track or large running area of known distance is required.

Table 10.6 Police officer standards for blood variables*

Fitness Category	20-29 yrs (n=89) Chol. (mg%)	Trig. (mg%)	Glu. (mg%)	UA (mg%)	30-39 yrs (n=85) Chol. (mg%)	Trig. (mg%)	Glu. (mg%)	UA (mg%)	40-52 yrs (n=30) Chol. (mg%)	Trig. (mg%)	Glu. (mg%)	UA (mg%)
Excellent	<102	28	67	3.7	<116	35	67	3.6	<143	33	66	3.8
Good	103-167	29-66	68-78	3.8-5.6	117-194	36-104	68-80	3.7-5.8	144-218	34-78	67-80	3.9-5.6
Average	168-199	67-104	79-83	5.7-6.5	195-233	105-173	81-86	5.9-6.9	219-255	79-209	81-87	5.7-6.5
Below Average	200-264	105-181	84-93	6.6-8.4	234-311	174-311	87-98	7.0-9.1	256-329	210-341	88-102	6.6-8.4
Poor	>265	182	94	8.5	> 312	312	99	9.2	>330	342	103	8.5

* Sample drawn after a standard 14-hour fast during which no food is allowed except water.

a = Cholesterol

b = Triglycerides

c = Glucose

d = Uric Acid

Table 10.7 Estimation of maximum oxygen intake (VO_2 max) and fitness classifications from Cooper's 1.5 mile and 12 minute run tests (9). *

Fitness Category	Age Groups								
	Under 30 yrs			30-39 yrs			40-49 yrs		
	1.5 mile (min:sec)	12-min (miles)	VO_2 max (ml/kg•min)	1.5 mile (min:sec)	12-min (miles)	VO_2 max (ml/kg•min)	1.5 mile (min:sec)	12-min (miles)	VO_2 max (ml/kg•min)
Excellent	Below 10:15	Above 1.75	Above 51.6	Below 11:00	Above 1.65	Above 48.1	Below 11:30	Above 1.55	Above 45.1
Good	12:00 to 10:16	1.50 to 1.74	42.6 to 51.5	13:00 to 11:01	1.40 to 1.64	39.2 to 48.0	14:00 to 11:31	1.30 to 1.54	35.5 to 45.0
Average	14:30 to 12:01	1.25 to 1.49	33.8 to 42.5	15:30 to 13:01	1.15 to 1.39	30.2 to 39.1	16:30 to 14:01	1.05 to 1.29	26.5 to 35.4
Below Average	16:30 to 14:31	1.0 to 1.24	25.0 to 33.7	17:30 to 15:31	0.95 to 1.14	25.0 to 30.1	18:30 to 16:31	0.85 to 1.04	25.0 to 26.4
Poor	16:31 and Above	0.9 and Below	24.9 and Below	17:31 and Above	0.94 and Below	24.9 and Below	18:31 and Above	0.84 and Below	24.9 and Below

* from THE NEW AEROBICS. Copyright © 1970 by Kenneth H. Cooper, M.D.

These field tests are not recommended for high-risk persons or as initial screening tests for officers over the age of 35. After these types of individuals have been screened and medically cleared by a physician, the above field tests can be used as additional fitness tests and as motivators to show progress through an exercise program. A six-week starter program is recommended prior to the administration of a 1.5-mile or 12-minute test. The starter program gives the officers a chance to get their legs partially conditioned and learn to pace themselves. Starter programs are described in Chapter 11.

Body Composition

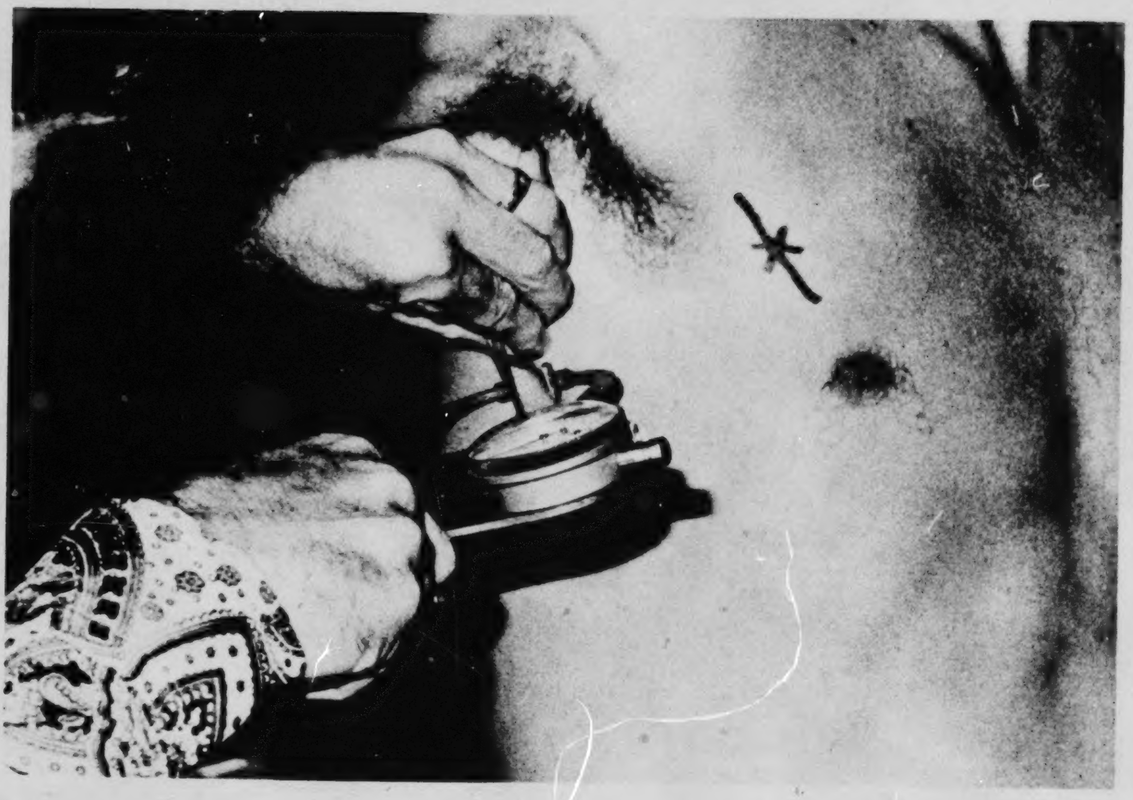
Body composition assessment refers to the classification of the total body weight into two main components - fat weight and lean weight. The amount of fat (percent of total body weight) in the body is related to heart disease, diabetes, cirrhosis of the liver, hernia, intestinal obstruction, and other health hazards. Thus it is recommended that percent body fat be maintained at a reasonable standard. The standard for men over age 35 is below 19 percent and for men under age 35, below 16 percent. Body composition is measured most accurately by underwater weighing. Through this technique, body density is calculated and converted to percent fat. The technique is a complex, expensive system with sophisticated procedures and is impractical for most situations. Thus, body composition must be estimated from simple field tests involving skinfold fat or body dimension measures. Specific recommendations on the exact locations for obtaining skinfold and girth measures are shown by Behnke and Wilmore (4).

Skinfold fat determinations involve the measurement of a double layer of skin and the underlying layer of fat by using special calipers that are calibrated to provide a constant tension throughout their range of motion. The Lange caliper (available through Sambridge Scientific Industries, Cambridge, Maryland) meets this specification and is relatively inexpensive. In measuring skinfold thicknesses, it is important to locate the exact site, pinch the skinfold firmly with the thumb and forefinger, and place the caliper at a constant distance from the thumb and forefinger holding the site (see Photographs 4, 5, and 6). Small differences among individuals exist in the thickness of skin; therefore, the above technique actually estimates individual differences in the fat layer.

A common formula used to estimate percent body fat for young men from three skinfold sites has been reported by Pascale et al. (18). A conversion table is presented in Table10.8. The scoring of percent fat is summarized as follows:

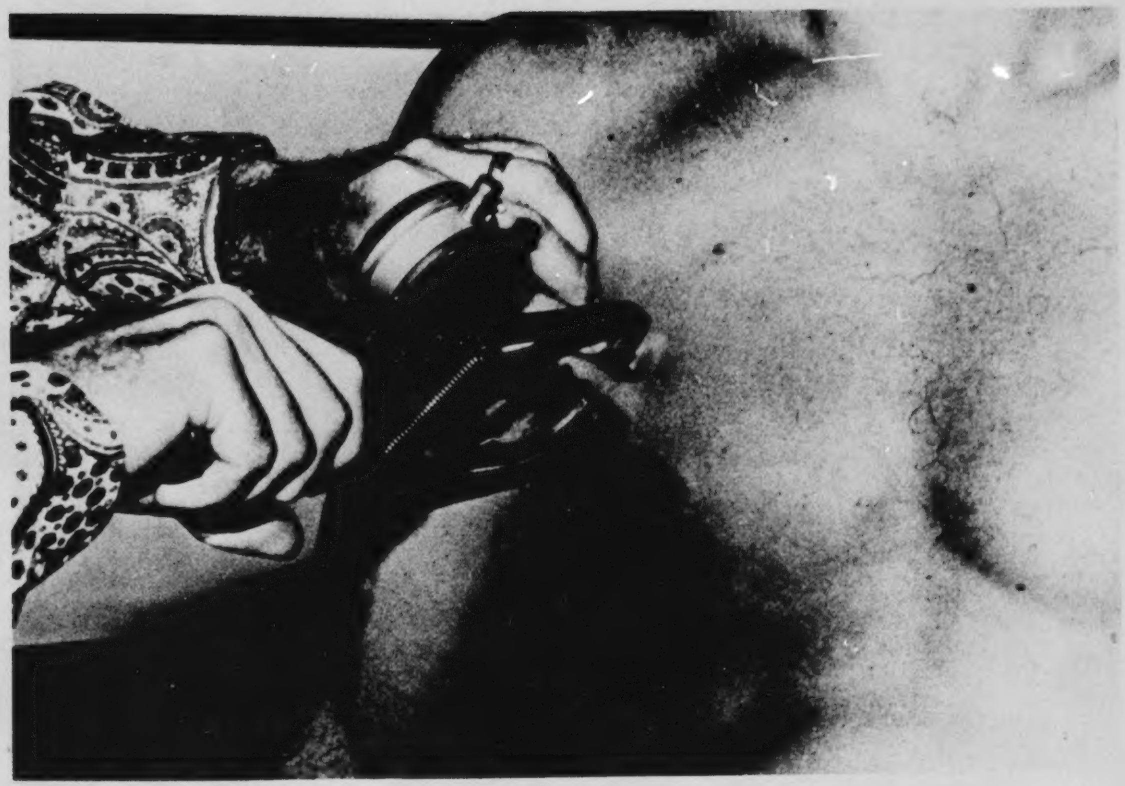
1. The three skinfold sites are measured to the nearest 0.5 millimeter.
2. The axilla measurement is a vertical skinfold at the middle of the side, level of the fifth rib, and directly in line with the middle of the armpit.
3. The chest location is found over the lateral border of the pectoralis major muscle midway between the nipple and shoulder crease and on a line running diagonally between the shoulder and opposite hip.
4. The triceps site is located on the back of the arm, over the belly of the triceps muscle, and midway between the top of the shoulder and the elbow joint.

Photograph #4



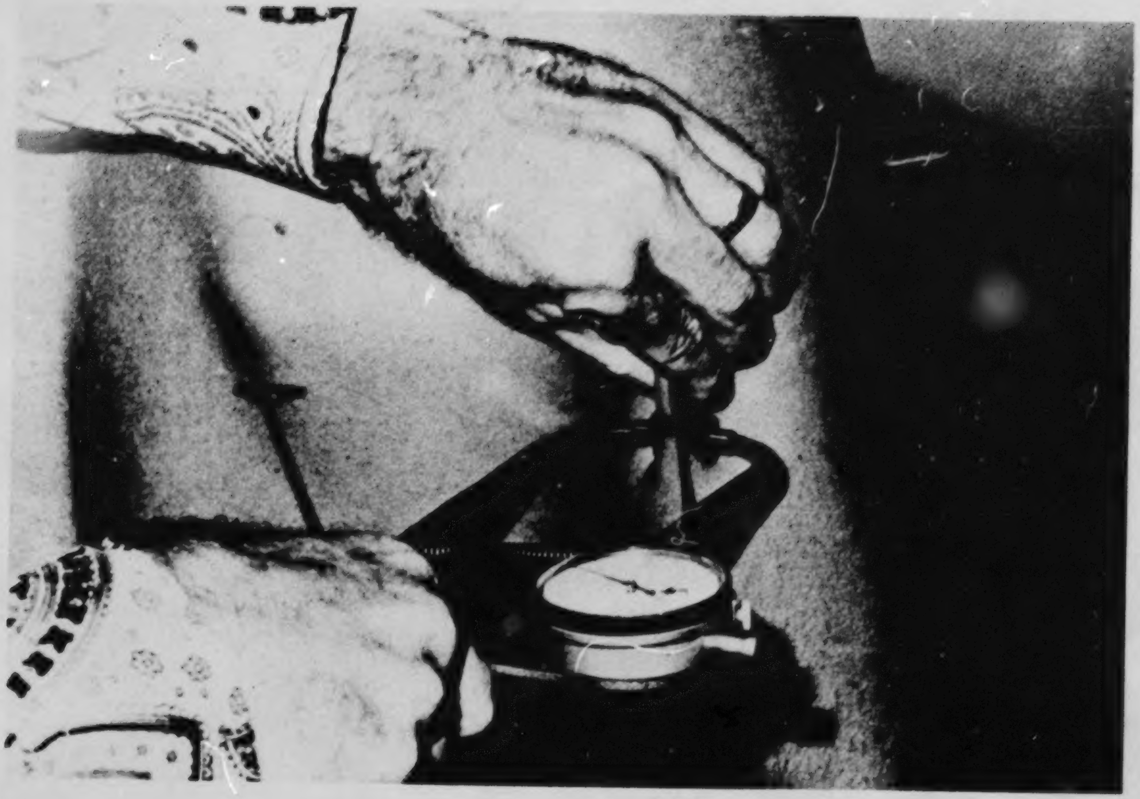
The Axilla Skinfold Measurement

Photograph #5



Skinfold Measurement at the Chest

Photograph #6



Skinfold Measurement of the Triceps

Table 10.8 Skinfold conversion table for prediction of percent body fat in males (18)

mm	Axilla	Chest	Tricep
1	.00071	.00048	.00055
2	.00142	.00097	.00110
3	.00214	.00145	.00165
4	.00285	.00193	.00220
5	.00356	.00242	.00276
6	.00427	.00290	.00331
7	.00499	.00338	.00386
8	.00570	.00387	.00441
9	.00641	.00435	.00496
10	.00712	.00483	.00551
11	.00783	.00532	.00606
12	.00855	.00580	.00662
13	.00926	.00628	.00717
14	.00997	.00677	.00772
15	.01068	.00725	.00827
16	.01140	.00773	.00882
17	.01211	.00822	.00937
18	.01282	.00870	.00992
19	.01353	.00918	.01048
20	.01425	.00967	.01103
21	.01496	.01015	.01158
22	.01567	.01063	.01213
23	.01638	.01112	.01268
24	.01710	.01160	.01323
25	.01781	.01208	.01378
26	.01852	.01257	.01433
27	.01923	.01305	.01489
28	.01994	.01354	.01544
29	.02066	.01402	.01599
30	.02137	.01450	.01654
31	.02208	.01498	.01709
32	.02279	.01547	.01764
33	.02351	.01595	.01819
34	.02422	.01644	.01874
35	.02493	.01692	.01930
36	.02564	.01740	.01985
37	.02636	.01788	.02040
38	.02707	.01837	.02095
39	.02778	.01885	.02150
40	.02849	.01934	.02205
41	.02920	.01982	.02260
42	.02992	.02030	.02316
43	.03063	.02079	.02371
44	.03134	.02127	.02426
45	.03205	.02175	.02481
46	.03277	.02244	.02436
47	.03348	.02272	.02591
48	.03419	.02320	.02648
49	.03490	.02369	.02701
50	.03562	.02417	.02756

Density	%Fat (3)	Density	% Fat (3)
1.0000	42.8	1.0525	20.0
1.0025	41.7	1.0550	19.0
1.0050	40.5	1.0575	17.9
1.0075	39.4	1.0600	16.9
1.0100	38.3	1.0625	15.9
1.0125	37.2	1.0650	14.9
1.0150	36.0	1.0675	13.9
1.0175	34.9	1.0700	12.9
1.0200	33.8	1.0725	11.9
1.0225	32.7	1.0750	10.9
1.0250	31.6	1.0775	9.9
1.0275	30.6	1.0800	8.9
1.0300	29.5	1.0825	8.0
1.0325	28.4	1.0850	7.0
1.0350	27.3	1.0875	6.0
1.0375	26.3	1.0900	5.1
1.0400	25.2	1.0925	4.1
1.0425	24.2	1.0950	3.2
1.0450	23.1	1.0975	2.2
1.0475	22.0	1.1000	1.2
1.0500	21.0		

Skinfolds in millimeters

Axilla 10 mm
Chest 11 mm
Triceps 12 mm

Skinfold Conversions

Axilla .00712
Chest + .00532
Triceps + .00662
Total .01906

Subtract above total from 1.08847 to get body density

1. 0 8 8 4 7
- .01906 Total
= 1.06941 Density

Circle percent fat corresponding to density on table above.

5. All measures are taken on the right side of the body.
6. The conversion factors for the three measurements are found in Table 10.8, and are summed. The total is subtracted from the constant 1.08847 to obtain density.
7. The density is converted to percent fat by using the values noted on Table 10.8 in the inset, which are based on the formula by Brozek _et al_. (5).

Another practical method for estimating percent fat for young men is presented in Table 10.9. Wilmore and Behnke (25) have reported a simple formula using body weight and waist girth measured at the umbilicus level. A metal or cloth tape measure is used to determine waist girth measured to the nearest half inch. The conversion factors are found for both body weight and waist girth and are added and subtracted to obtain lean body weight. Fat weight and percent body fat then are calculated as shown in the example in Table 10.9.

Pollock _et al_. (20) have reported a more accurate formula for predicting the body fat of middle-aged men using skinfold and girth measures. A conversion table for this formula is presented in Table 10.10. The chest and axilla skinfolds are taken to the nearest 0.5 mm and the gluteal and forearm girths are taken to the nearest 0.1 cm. The scoring for percent fat is summarized as follows:

1. The axilla skinfold conversion is _subtracted_ from the chest skinfold conversion to result in answer "a."
2. The gluteal girth conversion is _subtracted_ from answer "a" to result in answer "b."
3. The forearm girth conversion is _added_ to answer "b" to result in answer "c."

Table 10.9 Conversion table for estimation of percent fat (25)

Lean Body Weight (LBW) = 98.42 = [1.082 (Body Weight) - 4.15 (Waist Girth)]
% Fat = [Body Weight - Lean Body Weight x 100] ÷ Body Weight

NAME EXAMPLE DATE ______________

ACTUAL MEASUREMENTS

1. Body Weight 166 lb
2. Waist Girth 33 in

CONVERSION

Add the Constant to the Body Weight conversion factor (cf); subtract the Waist Girth conversion factor (cf) from the subtotal to get Lean Body Weight (LBW); subtract the LBW from Body Weight to get Fat Weight. Finally calculate percent fat from the formula below.

CALCULATION

Constant + 98.42

1. Body Weight cf + 178.53

Subtotal = 276.95

2. Waist Girth cf - 136.95

LBW = 140.00

3. Body Weight = 166.00

LBW - 140.00

Fat Weight = 26.00

4. Percent Fat = $\frac{(\text{Fat Wt} \times 100)}{(\text{Body Wt})}$

Percent Fat = $\frac{(26.00 \times 100)}{(166)}$

Percent Fat = 15.6

BODY WEIGHT	cf	WAIST GIRTH	cf
100 -	108.20	25.0 -	103.75
105 -	113.61	25.5 -	105.83
110 -	119.02	26.0 -	107.90
115 -	124.43	26.5 -	109.98
120 -	129.84	27.0 -	112.05
125 -	135.25	27.5 -	114.13
130 -	140.66	28.0 -	116.20
135 -	146.07	28.5 -	118.28
140 -	151.48	29.0 -	120.35
145 -	156.89	29.5 -	122.43
150 -	162.30	30.0 -	124.50
155 -	167.71	30.5 -	126.58
160 -	173.12	31.0 -	128.65
165 -	178.53	31.5 -	130.73
170 -	183.94	32.0 -	132.80
175 -	189.36	32.5 -	134.88
180 -	194.76	33.0 -	136.95
185 -	200.17	33.5 -	139.03
190 -	205.58	34.0 -	141.10
195 -	210.99	34.5 -	143.18
200 -	216.40	35.0 -	145.25
205 -	221.81	35.5 -	147.33
210 -	227.22	36.0 -	149.40
215 -	232.63	36.5 -	151.48
220 -	283.04	37.0 -	153.55
225 -	243.45	37.5 -	155.63
230 -	248.86	38.0 -	157.70
235 -	254.27	38.5 -	159.78
240 -	259.68	39.0 -	161.85
245 -	265.09	39.5 -	163.93
250 -	270.50	40.0 -	166.00

Table 10.10 Conversion Table for Prediction of Percent Body Fat (20)

NAME EXAMPLE

CHEST SKNFLD mm	CONV. FACTOR	AXILLA SKNFLD mm	CONV. FACTOR	GLUTEAL mm	CONV. FACTOR	FOREARM mm	CONV. FACTOR
1	1.10113	1	.00046	75	.075	17.5	.03973
2	1.10041	2	.00092	76	.076	18.0	.04086
3	1.09969	3	.00138	77	.077	18.5	.04200
4	1.09897	4	.00184	78	.078	19.0	.04313
5	1.09825	5	.00230	79	.079	19.5	.04427
6	1.09753	6	.00276	80	.080	20.0	.04540
7	1.09681	7	.00322	81	.081	20.5	.04654
8	1.09609	8	.00368	82	.082	21.0	.04767
9	1.09537	9	.00414	83	.083	21.5	.04881
10	1.09465	10	.00460	84	.084	22.0	.04994
11	1.09393	11	.00506	85	.085	22.5	.05108
12	1.09321	12	.00552	86	.086	23.0	.05221
13	1.09249	13	.00598	87	.087	23.5	.05335
14	1.09177	14	.00644	88	.088	24.0	.05448
15	1.09105	15	.00690	89	.089	24.5	.05562
16	1.09033	16	.00736	90	.090	25.0	.05675
17	1.08961	17	.00782	91	.091	25.5	.05789
18	1.08889	18	.00828	92	.092	26.0	.05902
19	1.08817	19	.00874	93	.093	26.5	.06016
20	1.08745	20	.00920	94	.094	27.0	.06129
21	1.08673	21	.00966	95	.095	27.5	.06243
22	1.08601	22	.01012	96	.096	28.0	.06356
23	1.08529	23	.01058	97	.097	28.5	.06470
24	1.08457	24	.01104	98	.098	29.0	.06583
25	1.08385	25	.01150	99	.099	29.5	.06697
26	1.08313	26	.01196	100	.100	30.0	.06810
27	1.08241	27	.01242	101	.101	30.5	.06924
28	1.08169	28	.01288	102	.102	31.0	.07037
29	1.08097	29	.01334	103	.103	31.5	.07151
30	1.08025	30	.01380	104	.104	32.0	.07264
31	1.07953	31	.01426	105	.105	32.5	.07378
32	1.07881	32	.01472	106	.106	33.0	.07491
33	1.07809	33	.01518	107	.107	33.5	.07605
34	1.07737	34	.01564	108	.108	34.0	.07718
35	1.07665	35	.01610	109	.109	34.5	.07832
36	1.07593	36	.01656	110	.110	35.0	.07945
37	1.07521	37	.01702	111	.111	35.5	.08059
38	1.07449	38	.01748	112	.112	36.0	.08172
39	1.07377	39	.01794	113	.113	36.5	.08286
40	1.07305	40	.01840	114	.114	37.0	.08399
41	1.07233	41	.01886	115	.115	37.5	.08513
42	1.07161	42	.01932	116	.116	38.0	.08626
43	1.07089	43	.01978	117	.117	38.5	.08740
44	1.07017	44	.02024	118	.118	39.0	.08853
45	1.06945	45	.02070	119	.119	39.5	.08967
46	1.06873	46	.02116	120	.120	40.0	.09080
47	1.06801	47	.02162	121	.121	40.5	.09194
48	1.06729	48	.02208	122	.122	41.0	.09307
49	1.06657	49	.02254	123	.123	41.5	.09421
50	1.06685	50	.02300	124	.124	42.0	.09534

MIDDLE-AGED MEN

Personal Measurements

CHEST 15 mm

AXILLA 12 mm

GLUTEAL 95 cm

FOREARM 25 cm

Conversions

CHEST 1.09105

-

AXILLA 0.00552

-

GLUTEAL 0.095

+

FOREARM 0.05675

=

DENSITY 1.04728

* % Fat = $\frac{4.95}{D} - 4.5$

Example:

% Fat = $\frac{4.95}{1.04728} - 4.5$

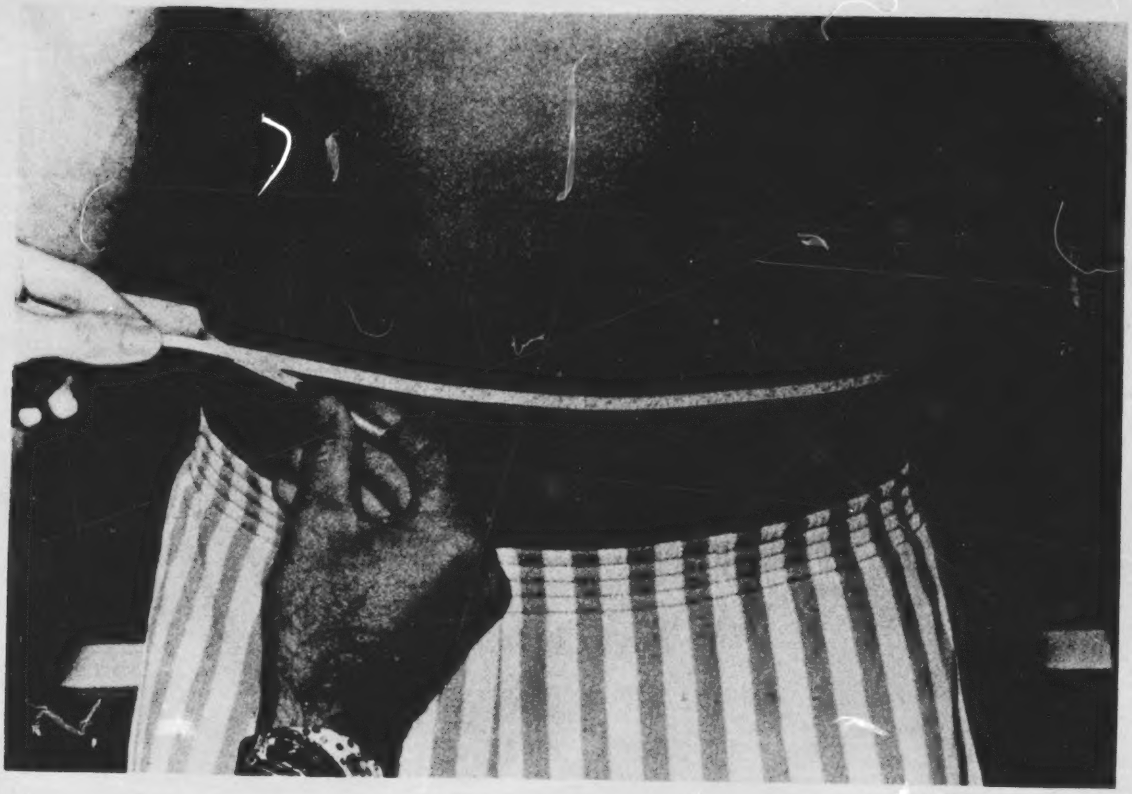
% Fat = 22.6

* Formula from Siri (24)

DENSITY = 1.10185 - 0.00072 * CHEST - 0.00046 * AXILLA - 0.001 * GLUTEAL + 0.00227 * FOREARM

R= 0.83 STD. ERROR 0.0075

Photograph #7



Measuring Waist Girth

4. Answer "c" value is actually equal to body density (D).
5. Density is then converted to percent body fat using the Siri Formula (24):

$$\% \text{ Fat} = \frac{4.95}{D} - 4.5 \quad x \quad 100$$

In the example on Table 10.10, the calculated percent body fat was 22.6.

Percent body fat norms by decade for police officers are presented in Table 10.11. The underwater weight technique was used to calculate the values for men 20 to 29 years of age and the Pollock _et al_. (20) formula was used for men over 30 years of age. The values for men over age 30 are much higher within each fitness category when compared to men under age 30. The desirable percent body fat standards recommended for men under age 30 and over age 30 are 16% and 19% or lower, respectively.

Motor Ability

Flexibility - Flexibility is included in total fitness assessment because of the widespread problems of low back pain and joint soreness. Many of these problems are related to sedentary living. Flexibility is defined as the range of possible movement in a joint or group of joints. It is necessary to determine the functional ability of the joints to move through a full range of motion.

No general flexibility test measures the flexibility of all joints; however, the trunk flexion or the sit and reach test serves as an important measure of hip and back flexibility. Primarily, the elasticity of the muscles in the back of the legs and trunk is tested in the sit and reach position. The subject sits on the floor or mat with legs extended at right angles to a taped line or box as shown in Figure 10.2. The heels touch the near edge of the

Table 10.11 Police officer standards for percent body fat.

Fitness Category	Age Groups		
	20-29 yrs (n=89)* Body Fat[a] (%)	30-39 yrs (n=85)** Body Fat[b] (%)	40-52 yrs (n=30)** Body Fat[b] (%)
Excellent	6.7 and below	13.8 and below	16.8 and below
Good	6.8 to 17.3	13.9 to 21.5	16.9 to 22.9
Average	17.4 to 22.6	21.6 to 2[illegible].4	23.0 to 26.0
Below Average	22.7 to 33.2	25.5 to 33.0	26.1 to 32.2
Poor	33.3 and above	33.1 and above	32.3 and above

Desirable body fat = 16% or lower

Desirable body fat = 19% or lower

= Body fat measured by underwater weight technique

= Body fat estimated by Pollock _et al_. (20) formula

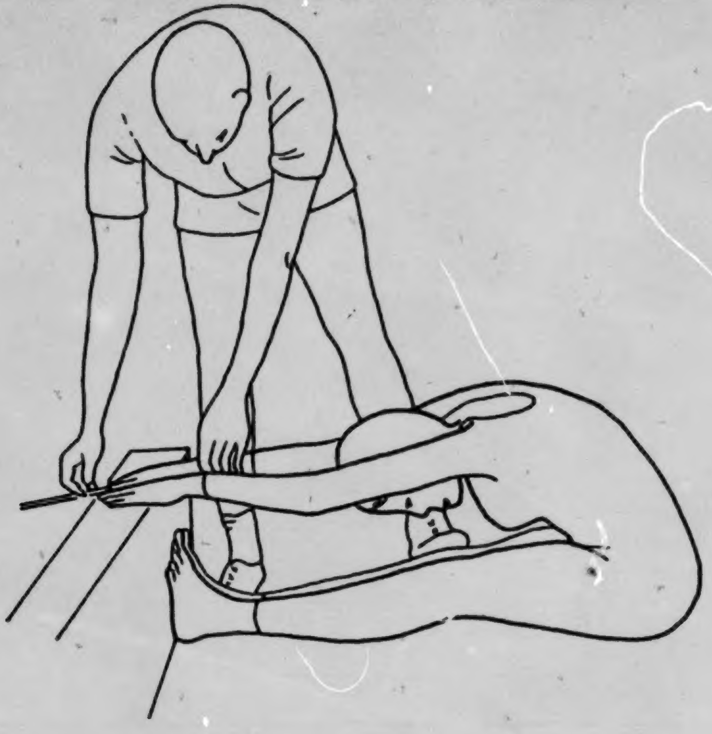


Figure 10.2. The sit and reach test for hip and back flexibility

tape or box and are eight inches apart. A yardstick is placed between the legs of the subject and rests on the floor with the 15-inch mark on the edge of the box. The subject slowly reaches forward with both hands as far as possible and holds the position momentarily. The distance reached on the yardstick by the fingertips is recorded. The best of three trials is considered as the flexibility score and can be compared to the norms in Table 10.12 prior to actual test administration, the officer should warm-up slowly by practicing the test.

Strength - Muscular strength is defined as the amount of tension a muscle can exhibit in one maximal contraction. The true measurement of total body muscular strength is difficult since so many muscle groups as well as different methods of testing strength are involved. A dynamic strength test through the full range of motion which correlates well with a total body strength criterion is the one repetition maximum bench press. The equipment required includes either a barbell set with a special bench or the bench press station on a Universal Gym apparatus. The procedures for this test involve the following.

1. Estimate the weight that an individual can press in one maximal effort.
2. Load the weights to about two-thirds of the estimated maximum weight.
3. Instruct the individual to press this weight once for an easy warm-up.
4. Increase the loading of the weights in ten pound increments to maximum. If barbells are used, five pound increments are

Table 10.12 Police officer standards for flexibility*

Fitness Category	Age Groups		
	20-29 yrs (n=81) Flexibility (in)	30-39 yrs (n=84) Flexibility (in)	40-52 yrs (n=28) Flexibility (in)
Excellent	25.9 and above	26.4 and above	23.3 and above
Good	19.7 to 25.8	19.2 to 26.3	16.3 to 23.2
Average	16.6 to 19.6	15.6 to 19.1	12.8 to 16.2
Below Average	10.5 to 16.5	8.4 to 15.5	5.7 to 12.7
Poor	10.4 and below	8.3 and below	5.6 and below

Sit and reach test (17)

recommended as the individual gets closer to maximum. Instruct the person to lift each additional weight increment for one repetition and then load the next increment. The first three to four repetitions serve as warm-up lifts in order to prevent muscle injury and to prepare the person for a maximal lift on the fifth or sixth effort.

5. The score for this test is the maximum number of pounds lifted in one repetition.

Norms for police officers on the one repetition maximum bench press are presented in Table 10.13. Because body weight is related to strength, additional norms on young men are provided in Table 10.14, according to body weight classifications. For example, a person weighing 166 pounds and bench pressing 180 pounds is rated in the good category. Norms in Table 10.14 are based on results from college-aged males and would apply primarily to police officers under age 30.

Muscular Endurance - Muscular endurance is defined as the ability to contract the muscle repeatedly over a period of time. Low levels of muscular endurance indicate inefficiency in movement and a low capacity to perform work. Two tests of muscular endurance which are easy to administer are the push-ups and one-minute timed sit-up tests. The correct technique for administering the push-up test is demonstrated in Photographs 8 and 9. The administrator places his fist on the floor below the officer's chest. The officer must keep his back straight at all times and from the up position lower himself to the floor until his chest touches the administrator's hand and then push to the up position again. The total number of correct push-ups are recorded and compared

Table 10.13 Police officer standards for one-repetition maximum bench press

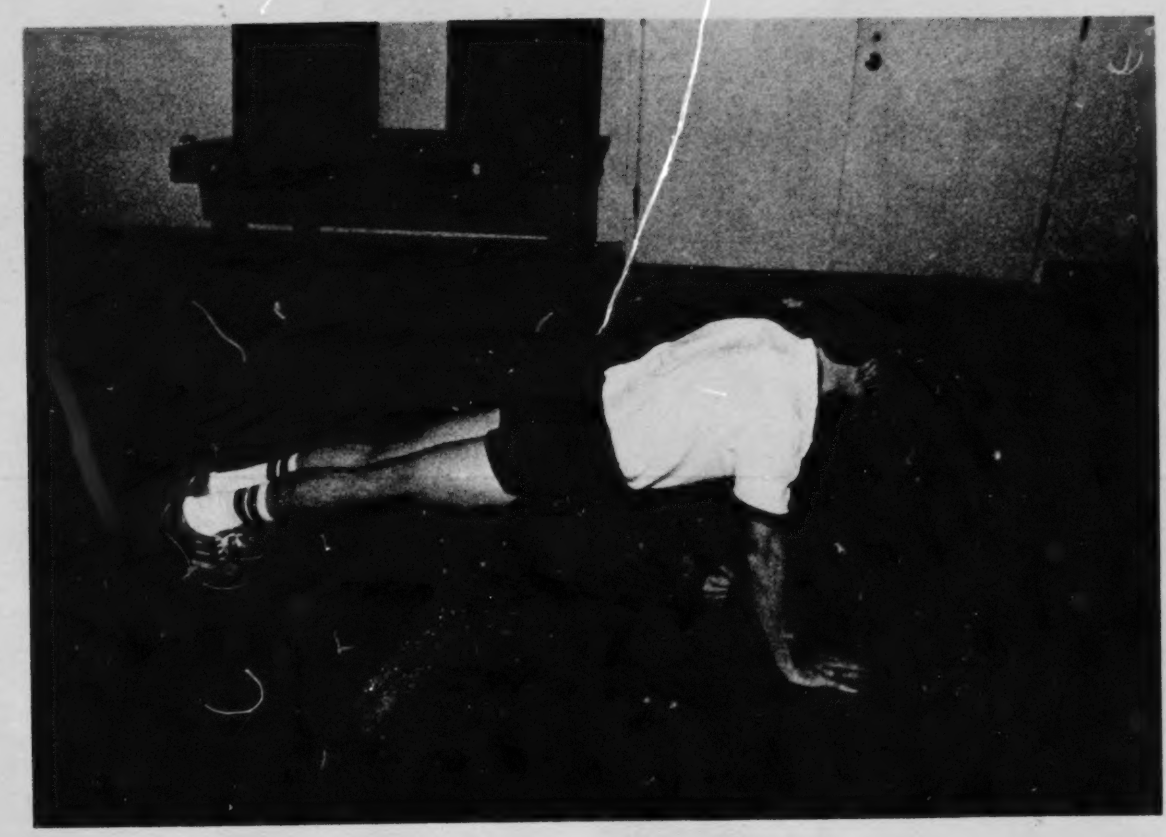
Fitness Category	Age Groups		
	20-29 yrs (n=81) Bench Press (lb)	30-39 yrs (n=83) Bench Press (lb)	40-52 yrs (n=28) Bench Press (lb)
Excellent	227 and above	201 and above	188 and above
Good	174 to 226	161 to 200	150 to 187
Average	147 to 173	141 to 160	132 to 149
Below Average	94 to 146	100 to 140	95 to 131
Poor	93 and below	99 and below	94 and below

Table 10.14 One repetition maximum bench press norms* for college-aged men.

itness ategory	Body weight classifications (lbs)							
	120-129	130-139	140-149	150-159	160-169	170-179	180-189	190-above
	Pounds Lifted							
xcellent	170-150	175-155	185-165	195-175	205-185	215-195	225-205	235-215
ood	145-130	150-135	160-145	170-155	180-165	190-175	200-185	210-195
verage	125-110	130-115	140-125	150-135	160-145	170-155	180-165	190-175
elow Average	105-90	110-95	120-105	130-115	140-125	150-135	160-145	170-155
oor	85-70	90-75	100-85	110-95	120-105	130-115	140-125	150-135

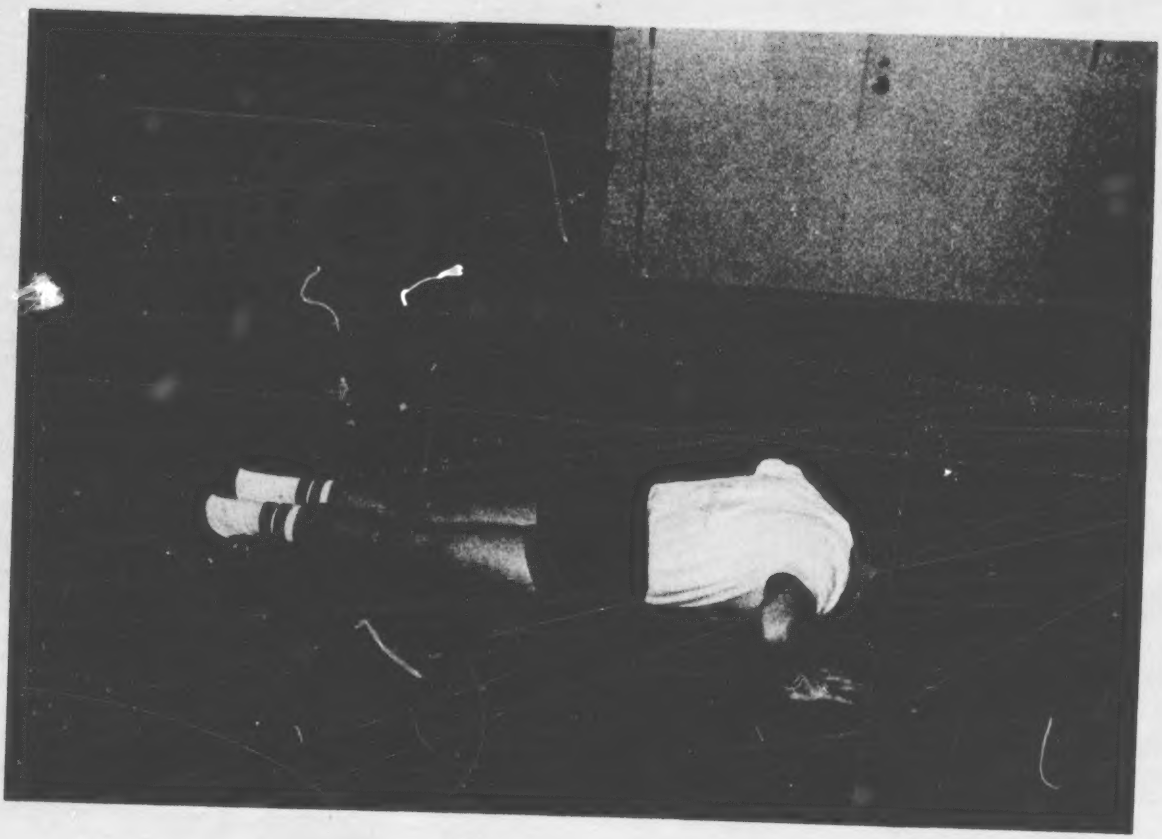
apted from data provided by R.A. Berger, Temple University.

Photograph #8



Push-Up Technique to
Measure Muscular Endurance,
Starting Position

Photograph #9



Push-Up Technique to
Measure Muscular Endurance.
lowered position

to the police officer standards shown in Table 10.15.

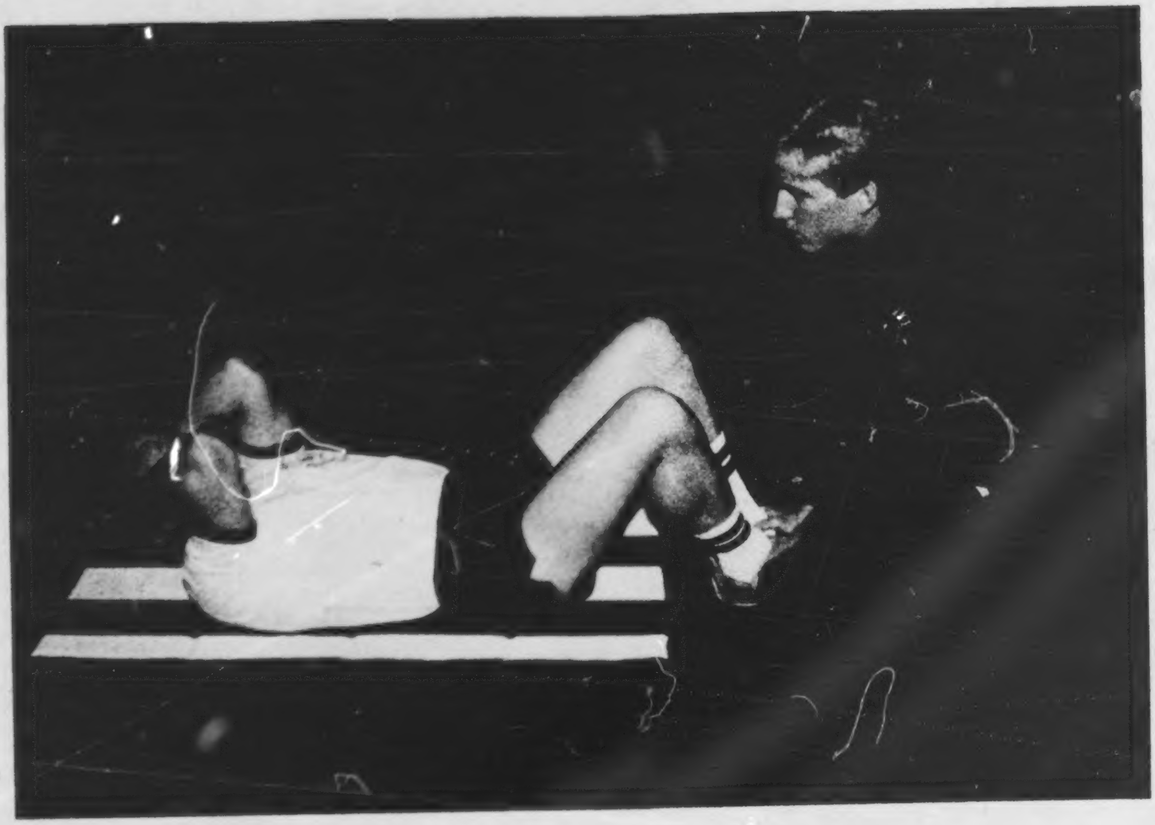
In the sit-up test, the officer starts by lying on his back, knees bent, heels flat on the floor, and hands interlocked behind the neck. A partner holds the feet down. The officer then performs as many correct situps as possible in one minute (see photographs 10 and 11). In the up position, the officer should touch his elbows to his knees and then return to a full lying position before starting the next situp. This test indicates the endurance of the abdominal muscle group, an area of important concern to the middle-aged male. Norms for this test are shown in Table 10.16.

Power - Power, in physical fitness terms, is defined as the ability to release maximum force in the fastest possible time. The vertical jump test has been used commonly as a measure of power. A yardstick, measuring tape, smooth wall or a specially made vertical jump board are required for the test. Chalk dust is placed on the fingers of one hand as a means for marking the jump. The officer stands with one side toward the measuring device and reaches upward as high as possible. This is recorded as the "reach" distance. The performer then jumps as high as possible and touches the measuring device at the height of his jump. The test is scored as the number of inches, measured to the nearest half-inch, between the "reach" and jump marks. The best of three trials is recorded as the score. Standards for young officers are presented in Table 10.17. The test was not given to officers over age 35.

Table 10.15 Police officer standards for the pushup test

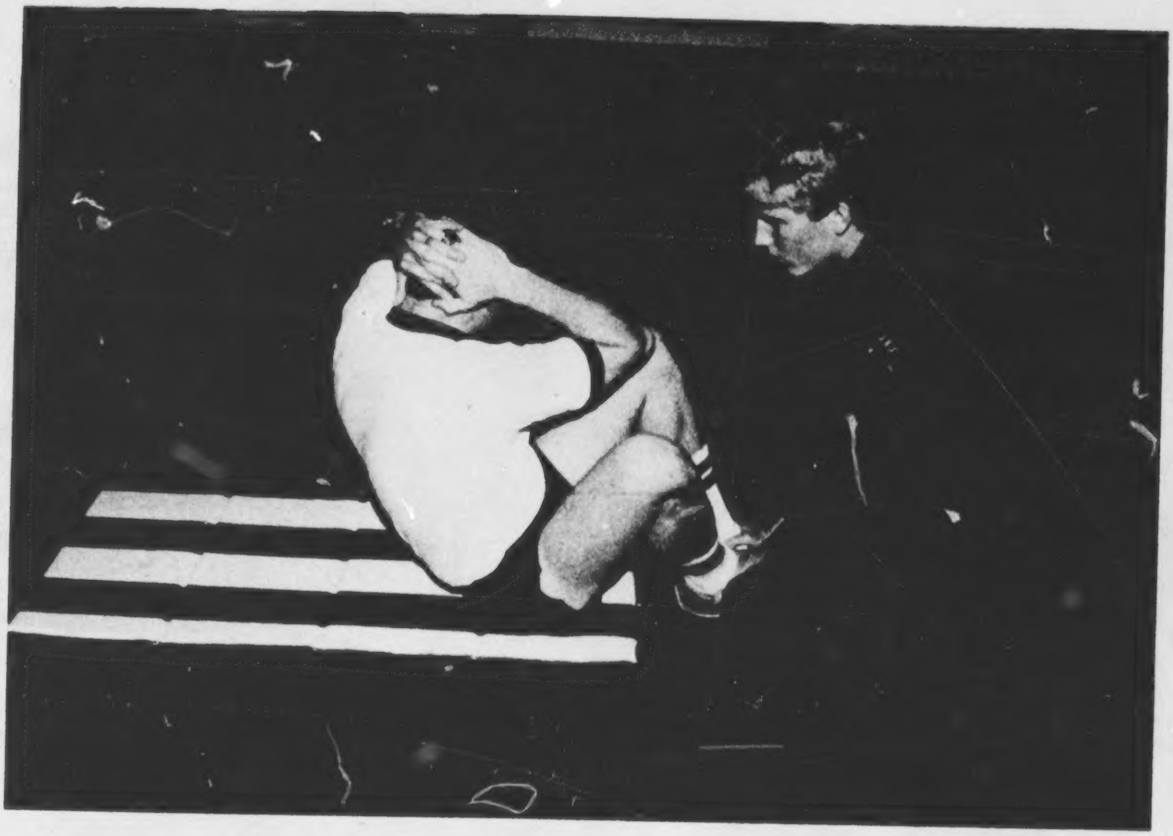
Fitness ategory	Age Groups		
	20-29 yrs (n=79) Pushups (repetitions)	30-39 yrs (n=83) Pushups (repetitions)	40-52 yrs (n=28) Pushups (repetitions)
Excellent	43 and above	37 and above	28 and above
Good	28 to 42	23 to 36	18 to 27
Average	20 to 27	17 to 22	13 to 17
Below Average	5 to 19	3 to 16	2 to 12
Poor	4 and below	2 and below	1 and below

Photograph #10



Sit-up Test, Starting Position

Photograph #11



Sit-up Test, Second Position

Table 10.16 Police officer standards for the one-minute situp test

Fitness Category	Age Groups		
	20-29 yrs (n=81) Situps (reps/min)	30-39 yrs (n=83) Situps (reps/min)	40-52 yrs (n=28) Situps (reps/min)
Excellent	51 and above	45 and above	39 and above
Good	40 to 50	34 to 44	26 to 38
Average	35 to 39	29 to 33	19 to 25
Below Average	24 to 34	18 to 28	6 to 18
Poor	23 and below	17 and below	5 and below

Table 10.17 Police officer standards for vertical jump power test.

Fitness Category	Age Groups	
	20-29 yrs (n=80) Vertical Jump (ins)	30-35 yrs (n=64) Vertical Jump (ins)
Excellent	25.0 and above	26.0 and above
Good	20.0 to 24.5	20.0 to 25.5
Average	17.5 to 19.5	16.5 to 19.5
Below Average	12.5 to 17.0	10.0 to 16.0
Poor	12.0 and below	9.5 and below

Agility - An agility run test reflects the ability to change directions and speed quickly. Several basic movements have been combined into one test in the figure-eight Illinois Agility Run. The test is described in detail by Cureton (11).

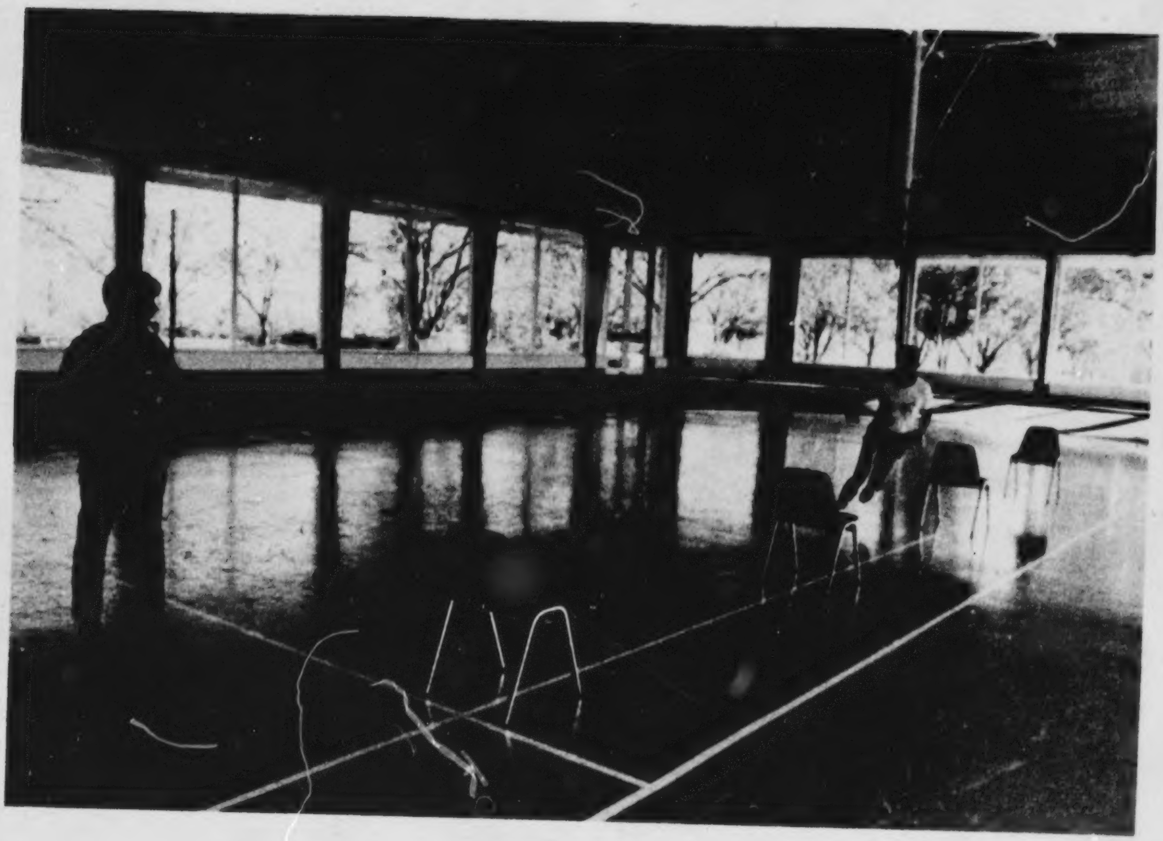
As shown in Photograph 12, the officer starts from a flat prone position with hands on the starting line and then reacts to the starting signal. The course consists of the following:

1. Sprint 30 feet, stride stop and place at least one foot over the boundary line, turn and sprint back 30 feet.
2. Left turn around chair on starting line and zig-zag in a figure-eight fashion around the chairs up and back (see Photograph 13).
3. Sprint 30 feet up and back as described in Step 1 above except finish with a dash over the starting line.

Photograph #12

Starting Position Figure-8
Illinois Agility Run

Photograph #13



Illinois Agility Run, Zigzag Technique

The total time to negotiate the course is recorded to the nearest 0.1 second. Gym shoes must be worn for the test and a warmup is required. Practicing the course by a slow jog is recommended as a warmup procedure. The best of two time trials is used as the agility score with at least five minutes of rest allowed between trials.

Norms on the agility run test for police officers are presented in Table 10.18. The test was not given to officers over age 35.

Table 10.18 Police officer standards for Illinois Agility Run Test (11)

Fitness Category	Age Groups	
	20-29 yrs (n=75) Agility Time (sec)	30-35 yrs (n=60) Agility Time (sec)
Excellent	16.1 and below	16.2 and below
Good	16.2 to 17.7	16.3 to 18.1
Average	17.8 to 18.6	18.2 to 19.1
Below Average	18.7 to 20.2	19.2 to 21.0
Poor	20.3 and above	21.1 and above

Discussion of Results

All test results should be explained carefully to each officer with opportunity for discussion. Strengths as well as weaknesses should be pointed out before an exercise prescription is given. A rating scale or profile chart is an excellent way of summarizing test results and presenting them visually to the officer for interpretation. Tables 10.19 to 10.24 show examples of how a fitness profile may be presented to officers of different ages. Space is also provided for recording actual scores on each table.

Table 10.19 Fitness Profile Chart for Police Officers, Ages 20-29 Years.

NAME________________________________ AGE________ HEIGHT____________ WEIGHT____________

Fitness Category	Resting Heart Rate beats/min	Bruce Treadmill Time min:sec	Maximum Oxygen Intake ml/kg•min	Three-Min. Step Test H.R. beats/min	1.5 Mile Run min:sec	12-min Run miles	Body Fat %
Excellent	Below 44	Above 13:12	Above 52.9	Below 69	Below 10:15	Above 1.75	Below 6.7
Good	45 58	13:11 11:24	52.8 44.8	70 97	10:16 12:00	1.74 1.50	6.8 17.3
Average	59 66	11:23 10:30	44.7 40.8	98 111	12:01 14:30	1.49 1.25	17.4 22.6
Below Average	67 79	10:29 8:42	40.7 32.8	112 139	14:31 16:30	1.24 1.00	22.7 33.2
Poor	80 Above	8:41 Below	32.7 Below	140 Above	16:31 Above	0.99 Below	33.3 Above

DATA COLLECTION FORM

Date

__________ Test 1 ________ ________ ________ ________ ________ ________ ________

__________ Test 2 ________ ________ ________ ________ ________ ________ ________

__________ Test 3 ________ ________ ________ ________ ________ ________ ________

Instructions: Record the individual's scores in the spaces provided above according to date of testing and type of test. Circle the individual's actual score in each test on the profile chart to identify varying levels of fitness.

Table 10.20 Fitness Profile Chart for Police Officers, Ages 20-29 Years.

NAME__________________________________AGE________HEIGHT__________WEIGHT________

Fitness Category	Flexibility (in)	Bench Press (lb)	Pushups (reps)	Situps (reps/min)	Vertical Jump (in)	Agility Run (sec)
Excellent	Above 25.9	Above 227	Above 43	Above 51	Above 25.0	Below 16.1
Good	25.8 19.7	226 174	42 28	50 40	24.5 20.0	16.2 17.7
Average	19.6 16.6	173 147	27 20	39 35	19.5 17.5	17.8 18.6
Below Average	16.5 10.5	146 94	19 5	34 24	17.0 12.5	18.7 20.2
Poor	10.4 Below	93 Below	4 Below	23 Below	12.0 Below	20.3 Above

DATA COLLECTION FORM

Date

_________Test 1 _________ _________ _________ _________ _________ _________

_________Test 2 _________ _________ _________ _________ _________ _________

_________Test 3 _________ _________ _________ _________ _________ _________

Instructions: Record the individual's scores in the spaces provided above according to date of testing and type of test. Circle the individual's actual score in each test on the profile chart to identify varying levels of fitness.

Table 10.21 Fitness Profile Chart for Police Officers, Ages 30-39 Years

NAME________________________________AGE__________HEIGHT_________WEIGHT__________

Fitness Category	Resting Heart Rate beats/min	Bruce Treadmill Time min:sec	Maximum Oxygen Intake ml/kg•min	Three-Min. Step Test H.R. beats/min	1.5 Mile Run min:sec	12-min Run miles	Body Fat %
Excellent	Below 44	Above 12:22	Above 47.4	Below 73	Below 11:00	Above 1.65	Below 13.8
Good	45 61	12:21 10:37	47.3 40.2	74 102	11:01 13:00	1.64 1.40	13.9 21.5
Average	62 69	10:36 9:44	40.1 36.6	103 117	13:01 15:30	1.39 1.15	21.6 25.4
Below Average	70 85	9:43 7:59	36.5 29.3	118 147	15:31 17:30	1.14 0.95	25.5 33.0
Poor	86 Above	7:58 Below	29.2 Below	148 Above	17:31 Above	0.94 Below	33.1 Above

DATA COLLECTION FORM

Date

__________Test 1 __________ __________ __________ __________ __________ __________ __________

__________Test 2 __________ __________ __________ __________ __________ __________ __________

__________Test 3 __________ __________ __________ __________ __________ __________ __________

Instructions: Record the individual's scores in the spaces provided above according to date of testing and type of test. Circle the individual's actual score in each test on the profile chart to identify varying levels of fitness.

Table 10.22 Fitness Profile Chart for Police Officers, Ages 30-39 Years.

NAME____________________________________ AGE______ HEIGHT_________ WEIGHT___________

Fitness Category	Flexibility (in)	Bench Press (lb)	Pushups (reps)	Situps (reps/min)	Vertical Jump (in)	Agility Run (sec)
Excellent	Above 26.4	Above 201	Above 37	Above 45	Above 26.0	Below 16.2
Good	26.3 19.2	200 161	36 23	44 34	25.5 20.0	16.3 18.1
Average	19.1 15.6	160 141	22 17	33 29	19.5 16.5	18.2 19.1
Below Average	15.5 8.4	140 100	16 3	28 18	16.0 10.0	19.2 21.0
Poor	8.3 Below	99 Below	2 Below	17 Below	9.5 Below	21.1 Above

DATA COLLECTION FORM

Date

________ Test 1 ________ ________ ________ ________ ________ ________

________ Test 2 ________ ________ ________ ________ ________ ________

________ Test 3 ________ ________ ________ ________ ________ ________

Instructions: Record the individual's scores in the spaces provided above according to date of testing and type of test. Circle the individual's actual score in each test on the profile chart to identify varying levels of fitness.

Table 10.23 Fitness Profile Chart for Police Officers, Ages 40-52 Years.

NAME ______________________________ AGE ________ HEIGHT ____________ WEIGHT ________

Fitness Category	Resting Heart Rate beats/min	Bruce Treadmill Time min:sec	Maximum Oxygen Intake ml/kg•min	Three-Min. Step Test H.R. beats/min	1.5-Mile Run min:sec	12-min Run miles	Body Fat %
Excellent	Below 48	Above 11:02	Above 40.1	Below 71	Below 11:30	Above 1.55	Below 16.8
Good	49 62	11:01 9:34	40.0 34.3	72 102	11:31 14:00	1.54 1.30	16.9 22.9
Average	63 69	9:33 8:49	34.2 31.4	103 117	14:01 16:30	1.29 1.05	23.0 26.0
Below Average	70 83	8:48 7:21	31.3 25.6	118 148	16:31 18:30	1.04 0.85	26.1 32.2
Poor	84 Above	7:20 Below	25.5 Below	149 Above	18:31 Above	0.84 Below	32.3 Above

DATA COLLECTION FORM

Date

__________ Test 1 __________ __________ __________ __________ __________ __________ __________

__________ Test 2 __________ __________ __________ __________ __________ __________ __________

__________ Test 3 __________ __________ __________ __________ __________ __________ __________

Instructions: Record the individual's scores in the spaces provided above according to date of testing and type of test. Circle the individual's actual score in each test on the profile chart to identify varying levels of fitness.

Table 10.24 Fitness Profile Chart for Police Officers, Ages 40-52 Years.

NAME____________________________AGE______HEIGHT______________WEIGHT_________

Fitness Category	Flexibility (in)	Bench Press (lb)	Pushups (reps)	Situps (reps/min)
Excellent	Above 23.3	Above 188	Above 28	Above 39
Good	23.2 16.3	187 150	27 18	38 26
Average	16.2 12.8	149 132	17 13	25 19
Below Average	12.7 5.7	131 95	12 2	18 6
Poor	5.6 Below	94 Below	1 Below	5 Below

DATA COLLECTION FORM

Date					
________	Test 1	________	________	________	________
________	Test 2	________	________	________	________
________	Test 3	________	________	________	________

Instructions: Record the individual's scores in the spaces provided above according to date of testing and type of test. Circle the individual's actual score in each test on the profile chart to identify varying levels of fitness.

The profile is used to indicate the officer's initial level of fitness but more importantly is used to show progress through a prescribed exercise program. Retesting then becomes an important requirement in the evaluation process. One of the most important impacts on an officer's attitude toward exercise is to be able to show progress as a result of the hard work required in an exercise program.

Summary

The medical screening examination helps to assure the health and safety practices of the program. The complete fitness profile including cardiovascular-respiratory, body composition, and motor ability measures identifies the level of fitness for an individual, enables proper exercise prescription, and demonstrates the progress that is possible through a systematic, supervised program.

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CHAPTER 11

RECOMMENDED EXERCISE PROGRAM PRESCRIPTION

Guidelines and Preliminary Considerations

Exercise prescription is dependent on needs (job description, likes and dislikes, etc.), goals, physical and health status, age, available time, and equipment and facilities. These factors vary greatly among police; therefore, the individual approach to exercise prescription is recommended (1, 3, 5, 6, 11, 12, 14, 17). Officers in the field have a greater need for muscular strength exercises than the police executive. Thus, training for the field officer should emphasize both cardiorespiratory endurance training and muscular strength exercises.

As an officer gets older, the need for a preventive health program becomes more evident. Results shown from the recent study conducted on 213 police officers showed them to be lower than average in cardiorespiratory fitness and higher in body fat than the average person. Their coronary risk factor profile for prediction of coronary heart disease became significantly higher with age. Lack of regular physical training was apparent in most police officers studied. Thus, as an officer gets older, emphasis should be placed more on the development and maintenance of cardiorespiratory fitness. The initial experience with endurance maintenance should be of low to moderate intensity and progression which allows for gradual adaptation. On the basis of experience with adult programs, the abrupt approach can result in discouraging future motivation for participation in endurance activities. Improper prescription also can lead to undue muscle strain or soreness, orthopedic problems, undue fatigue, and risk of precipitating a heart attack. The latter is rare and occurs mainly with middle-aged and older participants. Most incidents have occurred because of the lack of previous medical clearance and evaluation, incorrect exercise prescription, inadequate supervision, or an extreme climatic condition such as excess heat and humidity.

The intent of the programs recommended in this section is directed toward the police officer who would like an exercise program to develop and maintain cardiorespiratory fitness and desirable body fat composition and muscle tone. The following guidelines are geared to the healthy officer who is not physically disabled and has approximately one hour of time available 3 to 5 days per week. The following guidelines are suggested in the exercise prescription process:

Preliminary Suggestions

1. Adequate medical information available to assess health status properly.
2. Information concerning the present status of physical fitness and exercise habits.
3. Needs and objectives of the individual for being in an exercise program.
4. Realistic short-term and long-term goals.
5. Advice on proper attire and equipment for an exercise program.

Suggestions for Initial Phases of an Exercise Program

1. Proper education of persons as to the principles of exercise, exercise prescription, and methods of monitoring and recording exercise experiences.
2. Adequate physical leadership in the early stages of the exercise program to assure proper implementation and progress.
3. Education and leadership are the keys to a successful exercise program.

Long-Term Suggestions

1. Reevaluations are necessary for reassessing status of health, physical fitness, and exercise prescription.
2. Reevaluations are also important in the education and motivation processes.

The program can begin as soon as the health and fitness status and needs and objectives of the officers are determined. Having this information plus knowing the participants' activity interests and available time, the type and quantity of exercise may be determined. It is important for the initial exercise experience to be enjoyable, refreshing, and not too demanding either physiologically or time-wise. The slow, gradual approach to initiating an exercise program will help culture a more positive attitude toward physical activity and enhance the probability of long-term adherence. Also, if the prescribed program is too demanding, adherence is not very likely.

Cardiorespiratory Endurance and Weight Reduction

The research findings reported in Chapter 1 described the amount of work necessary to develop and maintain an optimal level of cardiorespiratory endurance. Within certain limits, the total energy cost (calories utilized) of a training regimen is the important factor in the development of cardiorespiratory endurance and weight reduction and control (13). This energy cost amounts to approximately 900 to 1500 calories per week or 300 to 500 calories per exercise session. Table 11.1 emphasizes the importance of frequency, intensity, and duration of training in attaining a certain level of calorie expenditure and gives general recommendations for exercise prescription.

Table 11.1 Recommendations for exercise prescription

1. Frequency	3 to 5 days/week
2. Intensity	60% to 90% of maximum heart rate 50% to 80% of maximum oxygen intake
3. Duration	15 to 60 minutes (continuous)
4. Mode-Activity	Run, jog, walk, bicycle, swim
5. Initial Level of Fitness	High = higher work load Low = lower work load

These recommendations are designed for the needs of the average police officer and not for highly trained endurance athletes, persons of low and/or poor health status, or severely handicapped individuals. Competitive runners usually exercise daily and cover approximately 100 miles per week. On the other extreme, certain debilitating diseases, such as coronary heart disease and arthritis, may greatly limit individuals in their initial stages of training.

1. Frequency - Exercise should be performed on a regular basis from three to five days per week. Although programs of sufficient intensity and duration show some cardiorespiratory improvements with less than three days per week training, no body weight or fat losses are found. Also, improvement in cardiorespiratory endurance is only minimal to modest in programs of less than three days per week (usually less than ten percent). Participants in one or two days per week programs often complain that the workout sessions are too intermittent and break the continuity of the training regimen. Another common complaint is that "It seemed as though I was starting anew each time I came out." Our experience has shown that these types of complaints often lead to dropouts

in a program. Under unusual conditions, if time and available space are important considerations, then one or two days per week regimens may be advisable and serve a temporary purpose.

Conditioning every other day is recommended when initiating an endurance exercise regimen. Daily exercise often becomes too demanding initially and does not allow enough time between workouts for the musculo-skeletal system to adapt properly. This nonadaptive state generally leads to undue muscle soreness, fatigue, and possible injury. This guideline may seem to contradict the research findings reported in Chapter 1 and the recommendations for exercise prescription shown in Table 11.1, however, the data from young men running 30 minutes, five days per week, or 45 minutes, three days per week showed them to incur injuries at a significantly higher rate than three days per week programs of 15 and 30 minute durations (15). In fact, the men in the three days per week programs had little or no injury problems. Most of the injuries that did occur concerned problems of the knee, shin, ankle, or foot.

Officers who are considered at a low level of fitness and whose initial programs are restricted to five to 15 minutes per session may want to exercise twice each day (6). An example of this special condition is a participant who is placed into a walking program of low intensity and short duration. In this case,an officer may adapt better to shorter but more frequent exercise sessions. Another substitute to exercising every other day is to alternate the regular exercise session with days of very mild activity. For officers who are initiating a jog-walk program, stretching and moderate warm-up exercises (calisthenics) for 10 to 15 minutes followed by a continuous walk for 20 to 30 minutes on alternate days are recommended.

Participants can begin to increase their frequency of training to a daily basis after several weeks or months of conditioning. The point in time at which this increase in frequency can be accommodated properly is an individual matter and is dependent upon age and initial level of fitness. Generally, persons of older ages and lower fitness levels are more prone to musculo-skeletal problems.

2. Intensity-Duration - Although intensity and duration are separate entities in themselves, it is difficult to discuss intensity without mentioning its interaction with duration (13). As mentioned in Chapter 1 , exercise regimens of lower intensity (less calorie expenditure) but with a longer duration period showed similar improvements to the higher and shorter duration regimens; the total calorie expenditures were approximately equal for both programs. The caloric difference between running a mile in eight minutes and running a mile in nine minutes is minimal; therefore, running a little extra time at the slower pace will offset the extra calories burned at the faster pace. The important concept is that a certain amount of total work should be completed in an exercise session (total calories), and the manner in which it is accomplished can vary.

The above-mentioned concept has important implications for exercise prescription for adults, and it should be remembered that low intensity-longer duration types of programs are generally recommended for beginners. This recommendation is particularly true for those officers showing a poor performance and/or presence of coronary heart disease on their initial evaluation. The important point is to prescribe a regimen at a low intensity so that the participant can accomplish a sufficient amount of work. Initially the prescription may call for a moderate to brisk walk for 20 to 30 minutes duration.

Table 11.1 outlines a certain minimal threshold of intensity which is necessary for improving cardiorespiratory function. As was mentioned in Chapter 1 under research findings, programs of less intensity than 60 percent of maximum capacity will show improvements in persons with low initial levels of fitness. These officers generally will qualify for fitness classifications I or II, as listed in Table 11.2. Special starter programs of less than 60 percent intensity are recommended for these individuals.

The training-duration will vary from day to day and from activity to activity. The important factor is to design a program that meets the criteria for improving and maintaining a sufficient level of physical fitness, is enjoyable (tolerable), and will fit into time demands.

The level of training intensity that can be tolerated will vary greatly depending on status of fitness and health, age, experience, and general ability. Long distance runners may tolerate two to three hours of continuous running at 80 to 90 percent of maximum capacity, but most beginners cannot perform a continuous effort at this level for more than a few minutes. In order for beginners to accomplish 20 to 30 minutes of continuous training, they must choose the proper intensity level. The proper intensity level for beginners will range from 60 to 70 percent of maximum capacity (brisk walking programs) to 70 to 80 percent of maximum capacity (combinations of walking and jogging). Most persons in fitness categories I and II (Table 11.2) will start with a walking program; and those in categories III and above, a combination walk-jog routine.

The walk-jog routine or low intensity-moderate intensity periods of work if performing another mode of activity will have a peak intensity of 85 to 90 percent of maximum capacity and a low intensity of 50 to 65 percent. The

Table 11.2 Fitness classifications for exercise prescription for various levels of cardiorespiratory endurance

Fitness Category	Max O_2 Intake (ml/kg min)	Mode of Estimating Maximum Oxygen Intake		
		Bruce Test[a] (min:sec)	1.5 Mile Run (min:sec)	Step Test[b] HR Count
I. Poor	31.5 and below	8:59 and below	15:01 and above	130 and above
II. Below Average	31.6 to 35.0	9:00 to 9:29	15:00 to 13:29	129 to 120
III. Average	35.1 to 42.5	9:30 to 10:59	13:30 to 12:01	119 to 95
IV. Good	42.6 to 51.5	11:00 to 13:59	12:00 to 9:31	94 to 85
V. Excellent	51.6 and above	14:00 and above	9:30 and below	84 and below

[a] Bruce treadmill test (2).

[b] Kasch and Boyer step test (9). For description of tests see Chapter 7.

average intensity level will range between 70 and 80 percent of maximum capacity (6). Experience has shown that an intensity level of 50 to 60 percent of maximum can be tolerated comfortably for 20 to 30 minutes by most persons and can be classified as low to moderate work. Intensity levels ranging from 70 to 85 percent are considered as moderate work and above 90 percent of maximum capacity, as high intensity work (13). The results of the initial tolerance test are important in placing the participant at a correct and safe level of intensity (6, 11, 14, 17).

Upon initiating an endurance training regimen, most officers notice the training effect rather quickly. They usually experience the ability to perform more total work in subsequent exercise sessions. The increased total work is a result of the ability of the participant to increase the training duration and/or to tolerate a greater work intensity. The increased average intensity is a function of a higher peak intensity level and/or an increase in the ratio of high to low bouts of work; for example, a participant in a walk-jog routine can tolerate longer periods of jogging interspersed with shorter amounts of walking. As these adaptations to training occur, changes in the exercise prescription are recommended. Periodic reevaluations will help in determining a new status of physical fitness and facilitate proper exercise prescription.

How is exercise intensity determined and how can it be estimated during an exercise session? As mentioned in Chapter 7 under evaluation procedures, intensity at various levels of effort as well as the ability to utilize oxygen (calories expended) are measured during a graded exercise test.

Heart rate and oxygen intake have a linear relationship (See Figure 11.1) (5). Thus, heart rate is an excellent means for estimating intensity of training.

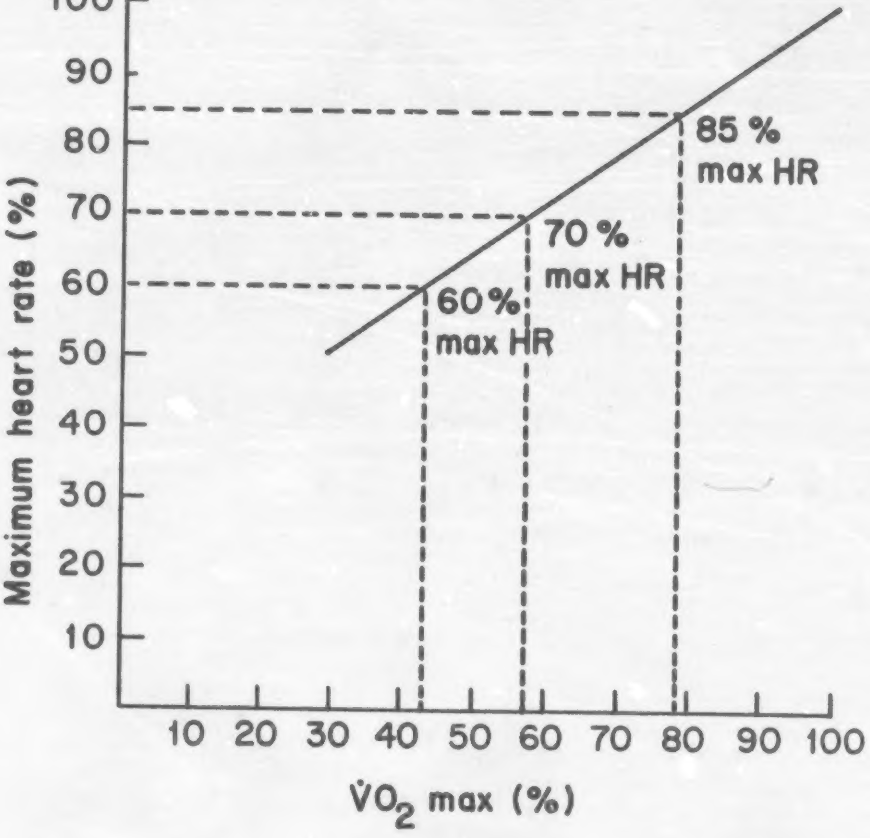
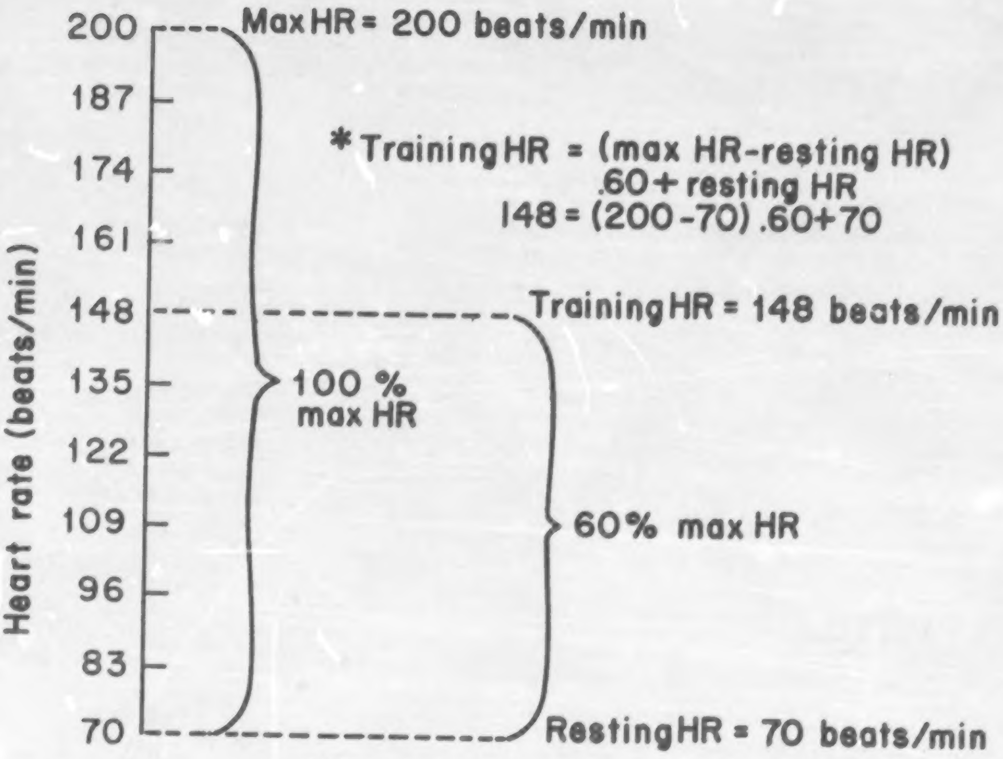

100
90
80
70
60
50
40
30
20
10
Maximum heart rate (%)
85 %
max HR
70 %
max HR
60 %
max HR
10
20
30
40
50
60
70
80
90
100
$\dot{V}O_2$ max (%)

FIGURE 11.1

Because of the impracticality of measuring oxygen intake and the ease in monitoring heart rate, the heart rate standard is recommended for general use.

To make an accurate estimation of intensity of training, it is necessary to know both resting and maximum heart rates (8). Maximum heart rate can be determined by using the highest heart rate found on a maximum graded exercise test, after a difficult bout of endurance exercise or by subtracting one's age from 220 (5). See Figure 11.2 for an example of calculating percent of maximum heart rate. The first method of estimating maximum heart rate is preferred because that heart rate is usually attained while qualified personnel are evaluating the performance of an officer. The second method is to count the heart rate after an all-out 12-minute run or similar endurance type field test (1.5 mile run). This type of test is not recommended for beginners or persons suspected of being coronary prone (4). The third method of determining maximum heart rate is the least accurate, but may be used as a rule of thumb. The inaccuracy of the third method stems from the variability of maximum heart rate at any given age. For example, the maximum heart rate of a man 50 years of age averages approximately 170 beats per minute, but in fact could vary from below 140 to over 200 beats per minute. Resting heart rate should be counted in the morning for 30 seconds while in a sitting position and before eating or smoking.

Estimating exercise heart rate during training usually is accomplished by counting the pulse rate immediately after stopping by means of the palpation technique (12). This technique is applied by placing the tips of the first two fingers lightly on the carotid artery (adjacent to the voice box) or the heel of the hand over the left side of the chest (at the apex of the heart) and by counting the pulsations. The pulse at the radial artery (wrist area) is generally more


200
187
174
161
148
135
122
109
96
83
70
Heart rate (beats/min)
Max HR = 200 beats/min
*Training HR = (max HR-resting HR) .60 + resting HR
148 = (200-70) .60+70
Training HR = 148 beats/min
100 % max HR
60% max HR
Resting HR = 70 beats/min

*Karvonen *et al* (8)

FIGURE 11.2

difficult to count after exercise and, thus, is not recommended. A few persons will not be able to count the pulse in this manner and will need to revert to the use of a stethoscope.

Heart rate begins to decelerate soon after cessation of exercising (usually after only 15 seconds); thus, the count should begin as soon as possible. It is recommended to count the pulse for ten seconds and to complete it within 15 seconds after completion of exercise. Only two to four seconds are needed to situate the hand properly and to feel the heart beat rhythm. Thus, by counting beats per ten seconds, it is possible to complete the count within 15 seconds and to avoid errors resulting from the deceleration of the heart beat.

A wristwatch, wall clock, or stopwatch can be used for determining heart rate; however, a stopwatch will be the most accurate. The stopwatch facilitates starting the count more quickly as well as general counting accuracy. After establishing the heart-rate rhythm, the count can start on a full beat with the first count being zero (can only start this way when using stopwatch). If the count does not end on an even beat, then one-half beat is added to the last full count. This counting detail is important with this technique because each one beat error in counting results in a six beat per minute error.

Another heart rate counting procedure that can be used satisfactorily is to count beats per 15 seconds. This method has some advantages: counting the heart rate over a longer time-span can reduce the errors in counting and multiplying the counted value by four to get beats per minute is easier for the beginner. The disadvantage is the five to ten percent error that may occur with the added counting time.

Each of the techniques requires some experimentation and practice to become proficient. Table 11.3 is a conversion chart for transforming raw heart data to beats per minute.

3. Mode of Activity - Many different types of activities can provide adequate stimulation for improving cardiorespiratory function. Chapter 2 emphasized that the total energy cost of a program is an important factor and that as long as various activities are of sufficient intensity and duration, the training effect will occur. Also, activities of similar energy requirements will provide similar training effects (13). In choosing the proper mode of training, the participant should be familiar with the variety of activities that are available. Table 11.4 categorizes activities by their calorie cost. An activity will vary in intensity depending on the enthusiasm of the participant as well as on the type of activity, e.g., singles or doubles; thus, a range of energy costs is listed in the table.

In general, an activity that expends less than five calories per minute is classified as "low" intensity and is not generally recommended for use in exercise regimens that are designed to develop cardiorespiratory fitness and weight reduction. An exception to this would be a person with a functional capacity in category I. These officers will improve their functional capacity with low intensity work, but should be encouraged to increase the duration of effort up to 60 minutes. Activities that expend five to ten calories per minute are considered of moderate intensity; activities from 10 to 14 calories per minute, moderate to high intensity; and activities greater than 14 calories per minute, high intensity. These classifications are based upon exercising continuously for up to 60 minutes.

Table 11.3 Conversion chart for transforming heart rate counted for 10 to 15 seconds to beats per minute.

HEART RATE			
beats/10 sec	beats/min	beats/15 sec	beats/min
15	90	23	92
16	96	24	96
17	102	25	100
18	108	26	104
19	114	27	108
20	120	28	112
21	126	29	116
22	132	30	120
23	138	31	124
24	144	32	128
25	150	33	132
26	156	34	136
27	162	35	140
28	168	36	144
29	174	37	148
30	180	38	152
31	186	39	156
32	192	40	160
33	198	41	164
34	204	42	168
		43	172
		44	176
		45	180
		46	184
		47	188
		48	192
		49	196
		50	200
		51	204

Table 11.4 Energy cost of various activities[1]

Activity	Calories[2] (cal/min)
Archery	3.7 - 5
Back Packing	6 - 13.5
Badminton	5 - 11
Basketball	
Non-game	3.7 - 11
Game	8.5 - 15
Bed Exercise (Arm movement supine or sitting)	1.1 - 2.5
Bicycling (Pleasure or to work)	3.7 - 10
Bowling	2.5 - 5
Canoeing (Rowing and kayaking)	3.7 - 10
Calisthenics	3.7 - 10
Dancing (Social and square)	3.7 - 8.5
Fencing	7.5 - 12
Fishing	
(Bank, boat or ice)	2.5 - 5
(Stream, wading)	6 - 7.5
Football (Touch)	7.5 - 12
Golf	
(Using power cart)	2.5 - 3.7
(Walking, carrying bag or pulling cart)	5 - 8.5
Handball	10 - 15
Hiking (Cross-country)	3.7 - 8.5
Horseback riding	3.7 - 10
Horseshoe pitching	2.5 - 3.7
Hunting, walking	
Small game	3.7 - 8.5
Big game	3.7 - 17
Jogging (See Table)	
Mountain Climbing	6 - 12
Paddleball (Racquet)	10 - 15
Sailing	2.5 - 6
Scuba Diving	6 - 12
Shuffleboard	2.5 - 3.7
Skating (Ice or roller)	6 - 10
Skiing (Snow)	
Downhill	6 - 10
Cross-country	7.5 - 15
Skiing (Water)	6 - 8.5
Snow Shoeing	8.5 - 17
Squash	10 - 15
Soccer	6 - 15
Softball	3.7 - 7.5
Stair-climbing	5 - 10
Swimming	5 - 10
Table-tennis	3.7 - 6
Tennis	5 - 11
Volleyball	3.7 - 6
Walking (See Table)	

[1] Energy cost values based on individual 154 pounds of body weight (70 kg).

[2] Calorie: A unit of measure based upon heat production. One calorie equals 200 ml of O_2 consumed.

When choosing the proper activity, the officer should take into account level of fitness, physical activity interests, availability of equipment and facilities, geographical location and climate. The deconditioned participant should be involved initially in several weeks or months of moderate activity that does not require competition or extreme starting and stopping movements. Under these conditions, many participants tend to overdo and become unduly stiff and sore, fatigued, and/or injured. The joints and muscular system are not adequately developed in a beginner to handle such demands; thus, the participant is vulnerable to injury. The need to get in shape to play games is true in most cases. Officers whose screening tests have indicated cardiovascular problems should avoid highly competitive type activities. It is important not to exceed the safe limit of exercise. The starter programs outlined later in this chapter are recommended for beginners.

Participation in a variety of activities is recommended and can be accomplished by interchanging some of the various activities listed in Table 11.4. Choosing different activities tends to keep a participant interested in endurance exercise over a long-term period. For example, one might jog 30 minutes on Monday and Thursday and play handball or basketball on Tuesday and Friday. The important factor is that the officer participates in these activities frequently and with sufficient intensity and duration.

Regardless of the type of physical activity used in a training program, each exercise session should begin with a warm-up period and finish with a cool-down period. The warm-up period should be from 10 to 15 minutes in duration and include a combination of stretching (flexibility) and light to moderate muscular strength and endurance exercises. This warm-up can be followed by five minutes of walking or slow jogging. Suggested stretching and muscular strength and endurance exercises are described later in this chapter.

The cool-down period should allow adequate time for the various bodily processes to readjust to normal. The length of the cool-down period is dependent on the difficulty of the endurance training period, status of physical fitness, and environmental conditions. Officers in better physical condition recover more quickly from vigorous activity. Exercising in a hot and humid environment generally will lengthen the recovery period. The cool-down period normally will last from five to ten minutes and can include a variety of activities such as slow jogging, walking, stretching, and light calisthenics.

Although the emphasis of this section was based upon the variety of activities available for developing and maintaining cardiorespiratory endurance, it must be remembered that such exercise is only a part of a total well-rounded program. Endurance activities are of paramount importance, but adequate flexibility and muscular strength and endurance add to a balanced physical fitness program.

Programs for Cardiorespiratory Fitness

The Aerobics Exercise System

The term "aerobics" was adapted from the word aerobic which refers to the type of metabolism utilizing oxygen in the production of energy for the body. Aerobics is a program of endurance exercises which require a sustained effort, e.g., running, bicycling, swimming, fast walking, and vigorous game-type activities. These types of exercises improve the efficiency of the cardiorespiratory system (heart, lungs, and blood vessels) and thus increase the ability of the body to transport and utilize oxygen.

Dr. Kenneth Cooper (3, 4) developed the aerobics program of endurance training. To make this program of training adaptable to the general public, a system of awarding points for various amounts of activity was devised. The point system is based upon the energy cost of the activity, i.e., the amount of oxygen utilized. Thus, the number of points achieved (energy cost) is dependent upon the intensity of the activity and its duration. Cooper suggests that a minimum of 30 points per week is necessary in order to maintain satisfactory cardiorespiratory condition. Thirty aerobic points per week is equal to approximately 30 minutes of walk/jogging, three days per week. The system is unique in that numerous activities can be combined or interchanged to meet the 30 points per week recommendation. The aerobics system is unique in that it can be used by most departments because its use is generally not dependent on size, facilities, location (city or rural), or environmental conditions.

Exercise Prescription for Cardiorespiratory Endurance

As mentioned earlier, in order to prescribe exercise properly, it is necessary to know something about the person's health status and physical fitness level. After undergoing the physical fitness examination (see Chapter 7), the officer may be classified into one of five categories of cardiorespiratory fitness. Table 11.2 shows the fitness classifications scores achieved on various tests. In order to be classified into the good level of cardiorespiratory fitness, a person should have a functional capacity of approximately 42 ml/kg/min. of oxygen intake. That level of fitness coincides with about 10:30

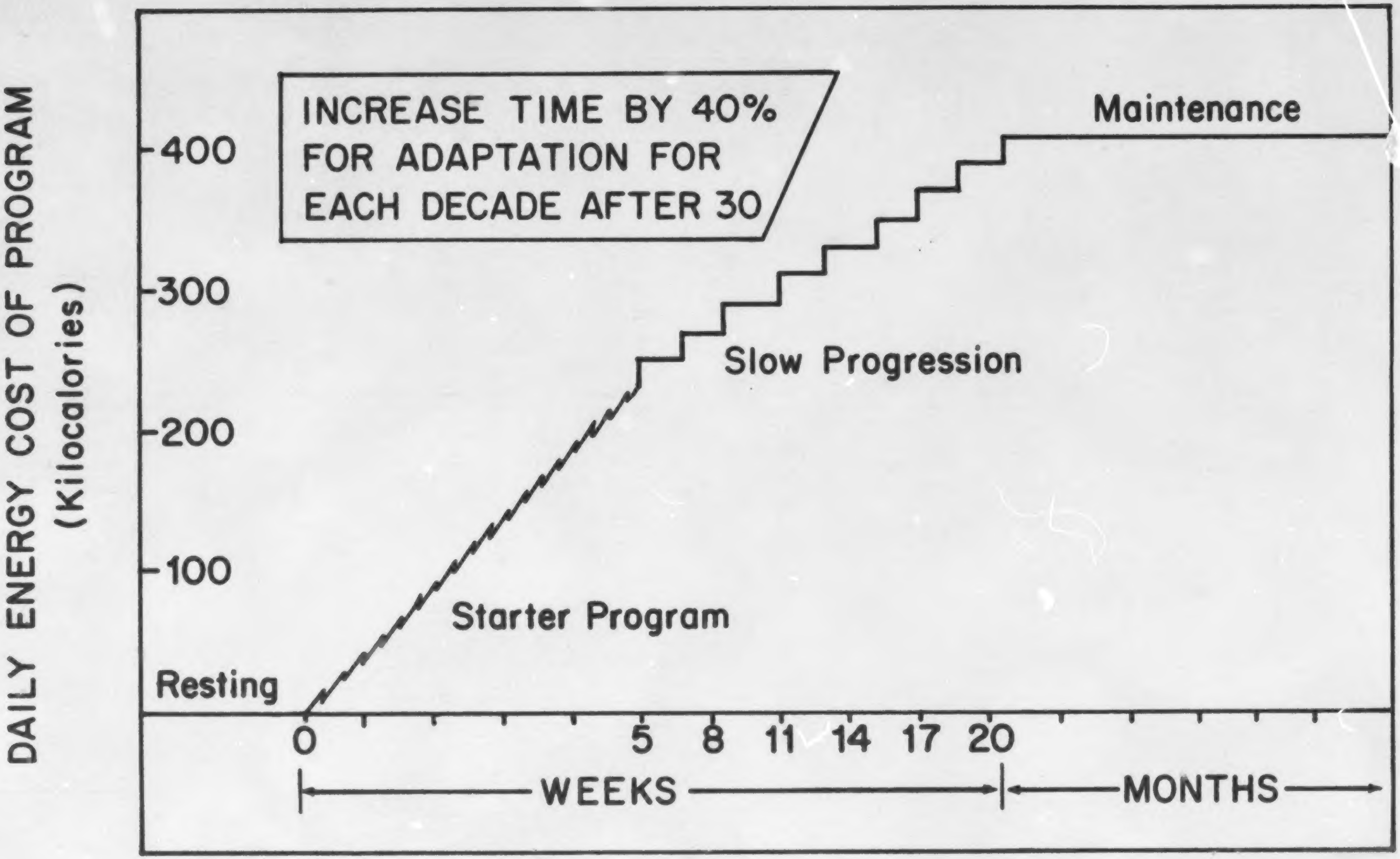
[redacted]

(min:sec) on the Bruce treadmill stress test, 12:00 minutes on the 1.5 mile test, and 90 (beats/min) total recovery heart rate on the three-minute step test. Therefore, knowing the initial level of cardiorespiratory fitness will help guide the participant into the correct program.

The exercise prescription usually has three stages of progression: starter, slow progression, and maintenance (see Figure 11.3). The initial stage of training is classified as a starter program. In this phase the exercise intensity is low and includes a lot of stretching and light calisthenics. The purpose at this stage of the program is to introduce the officer to exercise at a low level and to allow time to adapt properly to the initial weeks of training. If this phase is introduced correctly, the participant will experience a minimum of muscle soreness and can avoid debilitating injuries of the knee, shin, ankle,or foot. The latter injuries are common in the initial stages of a jogging program, but can be avoided if the participant takes some preliminary precautions, such as a good starter program, good running shoes, and proper warm-up and conditioning of the legs. Avoiding sharp turns and extremely hard running surfaces are also important safeguards (14).

The duration of the starter program is usually from four to six weeks, but is dependent on the adaptation of the participant to the program. For example, an officer who is classified in a poor or fair fitness level may spend as many as six to ten weeks in a starter program, but a participant scoring in the good to excellent categories may not need to participate in a starter program.

The slow progression stage of training differs from the starter phase in that the participant is progressed at a more rapid rate. During this stage, the duration and/or intensity are increased consistently every two to three weeks.



EXERCISE PRESCRIPTION: PROGRESSION IN TRAINING

FIGURE 11.3 Exercise prescription: progression in training

How well the person adapts to the present level of training dictates the frequency and magnitude of progression. As a general rule, the older the participant and the lower the initial fitness level, the longer one takes to adapt and progress in a training regimen. The adaptation to the training load takes approximately 40 percent longer for each decade in life after age 30. That is, if the progression in distance run is every two weeks for men of 30 to 39 years, then the interval may be three weeks for those of 40 to 49 years and four weeks for the 50 to 59 year-old group.

The maintenance stage of prescription usually occurs after six months to a year of training. At this stage, the participant has reached a satisfactory level of cardiorespiratory fitness and is no longer interested in increasing the training load. At this point further development is usually minimal, but the number of miles or minutes trained per week enables one to maintain fitness.

General Guidelines for Getting Started

In designing an exercise regimen one must select an activity which can be performed on a regular basis. Generally, game-type activities are not recommended in the early stages of training. Prior to becoming involved in game-type activities whereby running will be encountered, fast walking or walk-jog programs are recommended.

Table 11.4 lists the energy cost of a variety of activities commonly used in recreation and endurance fitness programs. The activities are quantified in terms of calories/minute. These values give inference as to the relative intensity of the effort. To get the total effect of the programs, one must determine the intensity level and multiply this by the total number of minutes of participation. Because games are not played continuously with an even amount of effort, some extrapolation will have to be made to get the intensity level for game-type activities. Intensity is dependent on how hard the game is played. If in doubt use the average value listed in Table 11.4. For example, if handball is played for 45 minutes, then the intensity in calories (12.5 cal/min) would be multiplied by the minutes played (45) to get the total calorie expenditure (562.5). The important point here is that the participant counts only the time that was used in participation. Rest breaks and waiting time do not count.

The energy cost of running and walking are listed in Table 11.5. An endurance training program can be designed from Table 11.5, but because of the difficulty of knowing the proper pace or sequence of progression, several programs are outlined in subsequent tables in this chapter. The programs include walking and running routines, stationary running, bench stepping, rope skipping, and various game-type activities and are designed relative to various levels of fitness.

Although walking and running can be done in a variety of settings, such as running tracks, roads, parks, etc., the course should be a measured distance. This can be accomplished by the use of an odometer from an automobile or bicycle or use of a measured track. Training on an oval track can get boring over a long period of time, but if available is a good way of getting started. Tracks generally have a smooth running surface and are of a known distance.

Table 11.6 will help in determining pace for walking and running programs. Speeds range from a slow walk (2.9 mph) to a fast run (12.5 mph). To aid in pacing, reference points of 110 yards or 440 yards are helpful. If carrying a stopwatch or wristwatch with a 60-second sweep hand, pace can be kept very

Table 11.5 Energy cost of walking and running[1]

Activity	Calories[2] (cal/min)	Speed mph	Speed min/mile (min:sec)
Walking	2.5	2.00	30:00
	3.0	2.50	24:00
	3.7	3.00	20:00
	4.2	3.50	17:08
	4.9	3.75	16:00
	5.5	4.00	15:00
	7.0	4.50	13:20
	8.3	5.00	12:00
Running	10.1	5.5	10:55
	12.0	6.0	10:00
	14.0	7.0	8:35
	15.6	8.0	7:30
	17.5	9.0	6:40
	19.6	10.0	6:00
	21.7	11.0	5:30
	24.5	12.0	5:00

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[1] Energy cost values based on individual 154 pounds of body weight (70 kg)

[2] Calorie: A unit of measure based upon heat production. One calorie equals 200 ml of O_2 consumed.

Table 11.6 Pacing chart for walking and running program conducted on track measured in 110 yard increments.

110 yd (sec)	Pace 440 yd (min:sec)	mph
18	1:12	12.5
19	1:16	11.8
20	1:20	11.2
21	1:24	10.7
22	1:28	10.2
23	1:32	9.8
24	1:36	9.4
25	1:40	9.0
26	1:44	8.6
27	1:48	8.3
28	1:52	8.0
29	1:56	7.7
30	2:00	7.5
31	2:04	7.3
32	2:08	7.0
33	2:12	6.8
34	2:16	6.6
35	2:20	6.4
36	2:24	6.2
37	2:28	6.1
38	2:32	5.9
39	2:36	5.8
40	2:40	5.6
41	2:44	5.5
42	2:48	5.4
43	2:52	5.2
44	2:56	5.1
45	3:00	5.0
46	3:04	4.9
47	3:08	4.8
48	3:12	4.7
49	3:16	4.6
50	3:20	4.5
51	3:24	4.4
52	3:28	4.3
53	3:32	4.2
54	3:36	4.2
55	3:40	4.1
56	3:44	4.0
57	3:48	3.9
58	3:52	3.9
59	3:56	3.8
60	4:00	3.7
61	4:04	3.7
62	4:08	3.6
63	4:12	3.6
64	4:16	3.5
65	4:20	3.5
66	4:24	3.4
67	4:28	3.4
68	4:32	3.3
69	4:36	3.3
70	4:40	3.2
71	4:44	3.2
72	4:48	3.1
73	4:52	3.1
74	4:56	3.0
75	5:00	3.0
76	5:04	2.9
77	5:08	2.9

accurately during the entire training program. Monitoring of the program by pace and heart rate response will help as a guide to proper initiation and progression of the training regimen.

Generally officers scoring in fitness categories I and II should begin their endurance training by walking. The walk should be at a comfortable but brisk pace. The initial speed will range from 3.0 to 4.0 mph. Distance (or time) will be approximately 1.5 to 2 miles (30 to 40 minutes). The reason behind this combination of walking speed and distance is to get the participant started at a comfortable pace and at the same time keeping the distance long enough so that one can begin to get an endurance training effect (total calories - aerobic points).

Even though the calorie cost of this regimen is low (125-150 calories), it will allow time for adaptation of most bodily systems and parts. Do not be concerned about not working hard enough. Time, with proper progression and adaptation, will eventually lead to the higher, more demanding levels of training.

Starter and Low-Level Conditioning Programs

Tables 11.7 to 11.15 outline various six-week starter programs, and Tables 11.16 to 11.24 are 16-week conditioning programs for fitness categories I, II, and III. All tables are developed for ages under 30, between 30 and 39 years, and between 40 and 49 years of age. These tables are taken from the book The New Aerobics (4). Programs for the age group 50 and over are available, but can be found only in The New Aerobics. If an officer is in a very low state of physical condition, the starter programs for under 30 (Tables 11.7 to 11.9), 30 to 39 years of age (Tables 11.10 to 11.12), and 40 to 49 years of age (Tables 11.13 to 11.15) are recommended. If the starter programs are too easy, then the participant can begin

Table 11.7[†] Walking starter program
(under 30 years of age)

Week	Distance (miles)	Time (min)	Freq/Wk	Points/Wk
1	1.0	15:00	5	5
2	1.0	14:00	5	10
3	1.0	13:45	5	10
4	1.5	21:30	5	15
5	1.5	21:00	5	15
6	1.5	20:30	5	15

Table 11.8[†] Combination walk-jog starter program
(under 30 years of age)

Week	Distance (miles)	Time (min)	Freq/Wk	Points/Wk
1	1.0	13:30	5	10
2	1.0	13:00	5	10
3	1.0	12:45	5	10
4	1.0	11:45	5	15
5	1.0	11:00	5	15
6	1.0	10:30	5	15

Table 11.9[†] Stationary running starter program
(under 30 years of age)

Week	Distance (min)	Steps/Min*	Freq/Wk	Points/Wk
1	2:30	70-80	5	4
2	5:00	70-80	5	7 1/2
3	5:00	70-80	5	7 1/2
4	7:30	70-80	5	11 1/4
5	7:30	70-80	5	11 1/4
6	10:00	70-80	5	15

* Count only when left foot hits the floor. Feet must be at least eight inches from the floor.

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Table 11.10[†] Walking starter program
(30-39 years of age)

Week	Distance (miles)	Time (min)	Freq/Wk	Points/Wk
1	1.0	17:30	5	5
2	1.0	15:30	5	5
3	1.0	14:15	5	10
4	1.0	14:00	5	10
5	1.5	21:40	5	15
6	1.5	21:15	5	15

Table 11.11[†] Combination walk-jog starter program
(30-39 years of age)

Week	Distance (miles)	Time (min)	Freq/Wk	Points/Wk
1	1.0	17:30	5	5
2	1.0	15:30	5	5
3	1.0	14:15	5	10
4	1.0	13:30	5	10
5	1.0	11:45	5	15
6	1.0	11:15	5	15

Table 11.12[†] Stationary running starter program *
(30-39 years of age)

Week	Duration (min)	Steps/Min*	Freq/Wk	Points/Wk
1	2:30	70-80	5	4
2	2:30	70-80	5	4
3	5:00	70-80	5	7 1/2
4	5:00	70-80	5	7 1/2
5	7:30	70-80	5	11 1/4
6	7:30	70-80	5	11 1/4

* Count only when left foot hits ground. Feet must be brought at least eight inches from floor.

[†] from THE NEW AEROBICS. Copyright © 1970 by Kenneth H. Cooper, M.D.

Table 11.13† Walking starter program
(40-49 years of age)

Week	Distance (miles)	Time (min)	Freq/Wk	Points/Wk
1	1.0	18:00	5	5
2	1.0	16:00	5	5
3	1.5	24:00	5	7 1/2
4	1.5	22:30	5	7 1/2
5	2.0	31:00	5	10
6	2.0	30:00	5	10

Table 11.14† Combination walk-jog starter program
(40-49 years of age)

Week	Distance (miles)	Time (min)	Freq/Wk	Points/Wk
1	1.0	18:00	5	5
2	1.0	16:00	5	5
3	1.0	15:00	5	5
4	1.0	14:15	5	10
5	1.0	13:45	5	10
6	1.0	12:45	5	10

Table 11.15† Stationary running starter program
(40-49 years of age)

Week	Duration (min)	Steps/min*	Freq/Wk	Points/Wk
1	2:30	70-80	5	4
2	2:30	70-80	5	4
3	5:00	70-80	5	7 1/2
4	5:00	70-80	5	7 1/2
5	5:00	70-80	5	7 1/2
6	7:30	70-80	5	11 1/4

* Count only when left foot hits the ground. Feet must be brought at least eight inches from floor.

† from THE NEW AEROBICS. Copyright © 1970 by Kenneth H. Cooper, M.D.

with Tables 11.16 to 11.24. Starter programs for swimming and cycling are described in The New Aerobics.

If the starter program is too easy or difficult then make an on-the-spot change in the program. Remember, the exercise prescription should be individualized. A satisfactory modification can usually be made by changing the speed or distance slightly (Tables 11.5 and 11.6).

The starter programs begin at a low level of conditioning with only five to 15 points earned per week in order to allow for proper adaptation. Through continuous progress training, the 30 point per week level may be achieved by the 10th to 15th week depending on the initial fitness category for the participant. Officers in fitness categories IV and V usually will progress to the 30 point per week level at a faster rate than participants in categories I, II, and III.

If the participant wants to play rigorous games such as handball or basketball for a conditioning regimen, he probably should spend several weeks in a walk-jog program first. Vigorous sport activities are more traumatic to the legs and feet than walking and jogging and often leave the unconditioned participant vulnerable to injury. The starter programs are conservative recommendations for beginning an exercise program. If the participant is not significantly overweight and feels that the starter programs are too easy, then he can progress to the seventh week of the conditioning program listed for his fitness category (Tables 11.16 to 11.24). A reevaluation at this time can assist the officer in the proper readjustment of his training load. Officers in fitness categories IV and V should begin with the programs listed in Table 11.25. More extensive point charts for running, walking, cycling, swimming, stationary

Table 11.16† Walking conditioning programs for fitness categories I, II, and III*

Fitness Category I (under 30 years of age)

Week	Distance (miles)	Time (min)	Freq/Wk	Points/Wk
7	2.0	28:00	5	20
8	2.0	27:45	5	20
9	2.0	27:30	5	20
10	2.0	27:30	3	22
	and			
	2.5	33:45	2	
11	2.0	27:30	3	22
	and			
	2.5	33:30	2	
12	2.5	33:15	4	26
	and			
	3.0	41:30	1	
13	2.5	33:15	3	27
	and			
	3.0	41:15	2	
14	2.5	33:00	3	27
	and			
	3.0	40:00	2	
15	3.0	41:00	5	30
16	4.0	55:00	3	33
	Fitness Category II			
7	2.0	27:30	5	20
8	2.0	27:30	3	22
	and			
	2.5	33:45	2	
9	2.0	27:30	3	22
	and			
	2.5	33:30	2	
10	2.5	33:15	3	27
	and			
	3.0	41:15	2	
11	2.5	33:00	3	27
	and			
	3.0	40:00	2	
12	3.0	41:00	5	30
13	4.0	55:00	3	33

† from THE NEW AEROBICS. Copyright © 1970 by Kenneth H. Cooper, M.D.

Table 11.16 (cont'd.)

Fitness Category III

Week	Distance (miles)	Time (min)	Freq/Wk	Points/Wk
7	2.5	33:15	4	26
	and			
	3.0	41:30	1	
8	2.5	33:00	3	27
	and			
	3.0	40:00	2	
9	3.0	41:00	5	30
10	4.0	55:00	3	33

* After completing the progressive walking program, use Table 11.25 to select a 30 point per week conditioning program.

Table 11.17† Combination walk-jog conditioning programs for fitness categories I, II, and III*

Fitness Category I (under 30 years of age)

Week	Distance (miles)	Time (min)	Freq/Wk	Points/Wk
7	1.5	18:30	5	15
8	1.5	17:30	5	15
9	1.5	16:30	4	18
10	1.0	9:30	3	21
	and			
	1.5	15:30	2	
11	1.0	8:45	3	24
	and			
	1.5	14:45	2	
12	1.0	8:30	3	24
	and			
	1.5	14:00	2	
13	1.0	8:15	3	24
	and			
	1.5	13:30	2	
14	1.0	7:55	3	27
	and			
	1.5	13:00	2	
15	1.0	7:45	2	31
	and			
	1.5	12:30	2	
	and			
	2.0	18:00	1	
16	1.5	11:55	2	32
	and			
	2.0	17:00	2	

Fitness Category II

Week	Distance (miles)	Time (min)	Freq/Wk	Points/Wk
7	1.5	17:30	5	15
8	1.5	16:30	4	18
9	1.0	9:30	3	21
	and			
	1.5	15:30	2	
10	1.0	8:45	3	24
	and			
	1.5	14:15	2	
11	1.0	8:15	2	26
	and			
	1.5	13:00	3	

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Table 11.17 (Con't.)

Fitness Category II (con't)

Week	Distance (miles)	Time (min)	Freq/Wk	Points/Wk
12	1.0 and	7:45	2	31
	1.5 and	12:30	2	
	2.0	18:00	1	
13	1.5 and	11:55	2	32
	2.0	17:00	2	

Fitness Category III

Week	Distance (miles)	Time (min)	Freq/Wk	Points/Wk
7	1.5	16:30	5	22
8	1.0 and	9:00	3	24
	1.5	14:45	2	
9	1.0 and	7:55	1	32
	2.0	18:00	3	
10	1.5 and	11:55	2	32
	2.0	17:00	2	

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* After the progressive walk-jog program, use Table 8.25 to select a 30 point per week conditioning program.

Table 11.18† Stationary running conditioning program for fitness categories I, II, and III*

Fitness Category I (under 30 years of age)

Week	Duration (min)	Steps/Min**	Freq/Wk	Points/Wk
7	10:00	70-80	5	15
8	12:30	70-80	5	18 3/4
9	12:30	70-80	5	18 3/4
10	15:00	70-80	5	22 1/2
11	15:00	70-80	5	22 1/2
12	10:00 and	80-90	1	24 1/4
	17:30	70-80	3	
13	12:30 and	80-90	3	27
	15:00	80-90	2	
14	12:30 and	80-90	3	28
	15:00	80-90	3	

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Table 11.18 (Con't)

Fitness Category I (con't)

Week	Duration (min)	Steps/Min**	Freq/Wk	Points/Wk
15	15:00	80-90	5	30
16	15:00	90-100	4	30

Fitness Category II

Week	Duration (min)	Steps/Min**	Freq/Wk	Points/Wk
7	12:30	70-80	5	18 3/4
8	15:00	70-80	5	22 1/2
9	15:00	70-80	5	22 1/2
10	12:30	80-90	3	27
	and			
	15:00	80-90	2	
11	12:30	80-90	2	28
	and			
	15:00	80-90	3	
12	15:00	80-90	5	30
13	15:00	90-100	4	30

Fitness Category III

Week	Duration (min)	Steps/Min**	Freq/Wk	Points/Wk
7	10:00	80-90	1	24 1/4
	and			
	17:30	70-80	3	
8	12:30	80-90	2	28
	and			
	15:00	80-90	3	
9	15:00	80-90	5	30
10	15:00	90-100	4	30

---

* After completing the progressive stationary running program, use Table 11.25 to select a 30 point per week conditioning program.

** Count only when left foot hits the floor. Feet must be brought at least eight inches from the floor.

Table 11.19† Walking conditioning programs for fitness categories I, II, III*

Fitness Category I (30 to 39 years of age)

Week	Distance (miles)	Time (min)	Freq/Wk	Points/Wk
7	1.5	21:00	5	15
8	2.0	28:45	5	20
9	2.0	28:30	5	20
10	2.0	28:00	5	20
11	2.0 and 2.5	28:00 35:30	3 2	22
12	2.5 and 3.0	35:00 43:15	3 2	27
13	2.5 and 3.0	34:45 43:00	3 2	27
14	2 and 3.0	34:30 43:30	3 2	27
15	3.0	42:30	5	30
16	4.0	56:30	3	33

Fitness Category II

Week	Distance (miles)	Time (min)	Freq/Wk	Points/Wk
7	2.0	28:30	5	20
8	2.0	28:00	5	20
9	2.0 and 2.5	28:00 35:30	3 2	22
10	2.5 and 3.0	34:45 43:00	3 2	27
11	2.5 and 3.0	34:30 42:30	3 2	27
12	3.0	42:30	5	30
13	4.0	56:30	3	33

Fitness Category III

Week	Distance (miles)	Time (min)	Freq/Wk	Points/Wk
7	2.5 and 3.0	35:00 43:15	3 2	27
8	2.5 and 3.0	34:30 42:30	3 2	27

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Table 11.19 (con't)

Fitness Category III

Week	Distance (miles)	Time (min)	Freq/Wk	Points/Wk
9	3.0	42:30	5	30
10	4.0	56:30	3	33

* After completing the progressive walking program, use Table 11.25 to select a 30 point per week conditioning program.

Table 11.20† Combination walk-jog conditioning programs for fitness categories I, II, III*

Fitness Category I (30 to 39 years of age)

Week	Distance (miles)	Time (min)	Freq/Wk	Points/Wk
7	1.5	19:30	5	15
8	1.5	18:30	5	15
9	1.5	17:30	4	18
10	1.0	10:00	2	19 1/2
	and 1.5	16:30	3	
11	1.0	9:30	3	21
	and 1.5	15:30	2	
12	1.0	9:00	3	24
	and 1.5	14:30	2	
13	1.0	8:30	3	24
	and 1.5	14:00	2	
14	1.0	8:15	3	30
	and 2.0	19:30	2	
15	1.0	8:00	2	31 1/2
	and 1.5	12:55	2	
	and 2.5	22:30	1	
16	1.0	8:00	1	34
	and 1.5	12:25	2	
	and 2.0	18:30	2	

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Table 11.20 (con't)

Fitness Category II

Week	Distance (miles)	Time (min)	Freq/Wk	Points/Wk
7	1.5	18:30	5	15
8	1.5	17:00	4	18
9	1.0	10:00	3	21
	and			
	1.5	15:45	2	
10	1.0	9:15	3	24
	and			
	1.5	14:30	2	
11	1.0	8:45	2	26
	and			
	1.5	13:00	3	
12	1.0	8:15	3	30
	and			
	2.0	19:30	2	
13	1.0	8:00	1	34
	and			
	1.5	12:25	2	
	and			
	2.0	18:30	2	

Fitness Category III

Week	Distance (miles)	Time (min)	Freq/Wk	Points/Wk
7	1.5	17:30	4	18
8	1.0	10:00	1	21
	and			
	1.5	15:15	4	
9	1.5	13:15	3	27
	and			
	2.0	19:30	1	
10	1.0	8:00	1	34
	and			
	1.5	12:25	2	
	and			
	2.0	18:30	2	

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* After completing the progressive walk-jog program, use Table 11.25 to select a 30 point per week conditioning program.

Table 11.21† Stationary running conditioning program for fitness categories I, II, and III*

Fitness Category I (30 to 39 years of age)

Week	Duration (min)	Steps/Min**	Freq/Wk	Points/Wk
7	10:00	70-80	5	15
8	10:00	70-80	5	15
9	12:30	70-80	5	18 3/4
10	12:30	70-80	5	18 3/4
11	15:00	70-80	5	22 1/2
12	10:00 and 17:30	80-90 70-80	1 3	24 1/4
13	10:00 and 17:30	80-90 70-80	1 3	24 1/4
14	12:30 and 15:00	80-90 80-90	2 3	28
15	15:00	80-90	5	30
16	15:00	90-100	4	30

Fitness Category II

Week	Duration (min)	Steps/Min**	Freq/Wk	Points/Wk
7	12:30	70-80	5	18 3/4
8	12:30	70-80	5	18 3/4
9	15:00	70-80	5	22 1/2
10	10:00 and 17:30	80-90 70-80	1 3	24 1/4
11	12:30 and 15:00	80-90 80-90	2 3	28
12	15:00	80-90	5	30
13	15:00	90-100	4	30

Fitness Category III

Week	Duration (min)	Steps/Min**	Freq/Wk	Points/Wk
7	10:00 and 17:30	80-90 70-80	1 3	24 1/4
8	12:30 and 15:00	80-90 80-90	2 3	28
9	15:00	80-90	5	30
10	15:00	90-100	4	30

†See next page
*See next page
**See next page

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* After completing the progressive stationary running conditioning program, use Table 11.25 to select a 30 point per week conditioning program.

** Count only when the left foot hits the floor. Feet must be brought at least eight inches from the floor.

Table 11.22† Walking conditioning programs for fitness categories I, II, and III*

Fitness Category I (40 to 49 years of age)

Week	Distance (miles)	Time (min)	Freq/Wk	Points/Wk
7	2.5	37:45	5	12 1/2
8	2.5	36:30	5	12 1/2
9	2.0 and 2.5	29:30 36:00	3 2	16
10	1.5 and 2.5	21:30 35:30	3 2	19
11	2.0 and 2.5	28:00 36:00	3 2	22
12	2.5 and 3.0	35:30 43:45	4 1	23
13	2.0 and 3.0	28:00 43:00	2 3	26
14	2.5 and 3.0	34:45 42:45	3 2	27
15	3.0	42:45	5	30
16	4.0	56:45	3	33

Fitness Category II

Week	Distance (miles)	Time (min)	Freq/Wk	Points/Wk
7	2.0 and 2.5	29:30 36:30	3 2	16
8	1.5 and 2.5	21:30 35:30	3 2	19
9	2.0 and 2.5	28:00 36:00	3 2	22
10	2.0 and 3.0	28:00 43:00	2 3	26

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Table 11.22 (con't)

Fitness Category II (con't)

Week	Distance (miles)	Time (min)	Freq/Wk	Points/Wk
11	2.5 and 3.0	34:45 42:45	3 2	27
12	3.0	42:45	5	30
13	4.0	56:45	3	33

Fitness Category III (40 to 49 years of age)

Week	Distance (miles)	Time (min)	Freq/Wk	Points/Wk
7	2.5 and 3.0	35:30 43:45	4 1	23
8	2.5 and 3.0	34:45 42:45	3 2	27
9	3.0	42:45	5	30
10	4.0	56:45	3	33

* After completing the progressive walking programs use Table 11.25 to select a 30 point per week conditioning program.

Table 11.23[†] Combination walk-jog conditioning programs for fitness categories I, II, and III*

Fitness Category I (40 to 49 years of age)

Week	Distance (miles)	Time (min)	Freq/Wk	Points/Wk
7	1.5	20:30	5	15
8	1.5	19:30	5	15
9	1.5	18:30	5	15
10	1.0 and 1.5	10:45 17:30	2 3	19 1/2
11	1.0 and 1.5	10:15 16:30	2 3	19 1/2
12	1.0 and 1.5	9:45 15:30	3 2	21
13	1.0 and 1.5	9:15 14:55	3 2	24

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Table 11.23 (con't)

Fitness Category I (40 to 49 years of age)

Week	Distance (miles)	Time (min)	Freq/Wk	Points/Wk
14	1.0	8:55	3	26
	and			
	2.0	20:30	2	
15	1.0	8:45	2	27
	and			
	1.5	14:00	2	
	and			
	2.0	20:00	1	
16	1.0	8:30	1	34
	and			
	1.5	13:25	2	
	and			
	2.0	19:30	2	

Fitness Category II (40 to 49 years of age)

Week	Distance (miles)	Time (min)	Freq/Wk	Points/Wk
7	1.5	19:30	5	15
8	1.5	18:00	5	15
9	1.0	10:45	3	18
	and			
	1.5	17:00	2	
10	1.0	10:00	1	21
	and			
	1.5	15:45	4	
11	1.0	9:30	2	26
	and			
	1.5	14:30	3	
12	1.0	9:30	1	32
	and			
	2.0	20:30	4	
13	1.0	8:30	1	34
	and			
	1.5	13:25	2	
	and			
	2.0	19:30	2	

Table 11.23 (con't)

Fitness Category III

Week	Distance (miles)	Time (min)	Freq/Wk	Points/Wk
7	1.5	18:30	5	15
8	1.0	10:45	3	18
	and 1.5	16:30	2	
9	1.5	14:15	2	26
	and 2.0	20:30	2	
10	1.0	8:30	1	34
	and 1.5	13:25	2	
	and 2.0	19:30	2	

* After completion of the progressive walk-jog program, use Table 11.25 to select a 30 point per week conditioning program.

Table 1124† Stationary running program for fitness categories I, II, and III*

Fitness Category I (40 to 49 years of age)

Week	Duration (min)	Steps/Min**	Freq/Wk	Points/Wk
7	7:30	70-80	5	11 1/4
8	10:00	70-80	5	15
9	10:00	70-80	5	15
10	12:30	70-80	5	18 3/4
11	12:30	70-80	5	18 3/4
12	15:00	70-80	5	22 1/2
13	10:00	80-90	1	24 1/4
	and			
	17:30	70-80	3	
14	12:30	80-90	2	28
	and			
	15:00	80-90	3	
15	17:30	70-80	4	27
16	20:00	80-90	3	30

Fitness Category II

Week	Duration (min)	Steps/Min**	Freq/Wk	Points/Wk
7	10:00	70-80	5	15
8	12:30	70-80	5	18 3/4
9	12:30	70-80	5	18 3/4
10	10:00	30-90	1	24 1/4
	and			
	17:30	70-80	3	
11	12:30	80-90	2	28
	and			
	15:00	80-90	3	
12	17:30	70-80	4	27
13	20:00	80-90	3	30

Fitness Category III

Week	Duration (min)	Steps/Min**	Freq/Wk	Points/Wk
7	15:00	70-80	5	22 1/2
8	12:30	80-90	2	28
	and			
	15:00	80-90	3	
9	17:30	70-80	4	27
10	20:00	80-90	3	30

* After completing the progressive stationary running program use Table 11.25 to select a 30 point per week conditioning program.

** Count only when the left foot hits the floor. Feet must be brought at least eight inches from the floor.

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running, and other activities are shown in Tables 11.26 and 11.27.

Maintenance Programs for Cardiorespiratory Fitness and Weight Control

Upon completion of the six-week starter and other programs outlined in Tables 11.7 to 11.25 a substantial improvement in fitness should have been attained. To maintain fitness, a specific program should be designed that will have similar aerobic point value (calorie cost) as the initial program and also satisfy the needs of the participant over a long time span. For many, walking and jogging may become boring and thus variety should be introduced into their program. The important thing is that participation in activities that are enjoyed are more likely to be continued.

One should check over the list of activities in Table 11.4 to see which ones best meet his interest and can still give the calorie output necessary for maintenance. Fitness is not stored but must be practiced continually. The guidelines for frequency, intensity, and duration of training do not change and should be taken into consideration when selecting activities for participation.

If goals have not been met or further development is required, then added calorie expenditure (aerobic points) is needed. For example, ideal weight may not be attained in a sixteen-week program, thus the program design should increase calorie output. Usually added frequency of training of up to five or six days per week will greatly increase the total energy expenditure. The addition of one extra 400 calorie (20 aerobic points) workout per week to the training regimen will decrease one pound of body fat every nine weeks. If this is matched by a similar reduction in food intake, it will amount to a reduction of 12 pounds in a year.

Table 11.25† Suggested conditioning programs for fitness for categories IV and V.

	Distance (miles)	Time (min) Requirement	Freq/Wk	Points/Wk
Walking	2.0 or	24:00-29:00	8	32
	3.0 or	36:00-43:30	5	30
	4.0 or	58:00-79:59	5	35
	4.0	48:00-58:00	3	33
Running	1.0 or	6:30-7:59	6	30
	1.5 or	12:00-14:59	5	30
	1.5 or	9:45-11:59	4	30
	2.0 or	16:00-19:59	4	36
	2.0	13:00-15:59	3	33
Cycling	5.0 or	15:00-15:59	3	33
	6.0 or	18:00-19:59	6	30
	7.0 or	21:00-27:59	4	36
	8.0	35:00-31:59	3	31
	Yards			
Swimming	500 or	8:20-12:59	8	32
	600 or	10:00-14:59	6	30
	800 or	13:20-19:59	4	30
	1000	16:40-24:59	3	31 1/2

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Table 11.25 (con't)

Suggested conditioning programs for fitness for categories IV and V.

	Duration (min)	Steps/Min*	Freq/Wk	Points/Wk
Stationary Running	10:00 in am	70-80	5	30
	and			
	10:00 in pm	70-80		
	or			
	15:00	70-80	7	30
	or			
	15:00	80-90	5	30
	or			
	20:00	70-80	4	32

* Count only when the left foot hits the floor. Feet must be brought at least eight inches from the floor.

	Duration	Freq/Wk	Points/Wk
Handball Basketball Squash	40:00*	5	30
	or		
	50:00	4	30
	or		
	70:00	3	30

* Continuous exercise; do not count breaks and time-outs.

Table 11.26 Supplemental point chart for running and walking

(from THE NEW AEROBICS. Copyright © 1970 by Kenneth H. Cooper, M.D.)

1.0 Mile	
19:59---14:30 min	1
14:29---12:00 min	2
11:59---10:00 min	3
9:59----8:00 min	4
7:59----6:31 min	5
6:30----5:45 min	6
under----5:45 min	7

1.5 Miles	
29:59---21:45 min	1 1/2
21:44---18:00 min	3
17:59---15:00 min	4 1/2
14:59---12:00 min	6
11:59----9:45 min	7 1/2
9:44----8:40 min	9
under----8:40 min	10 1/2

2.0 Miles	
40:00 min or longer	1*
39:59---29:00 min	2
28:59---24:00 min	4
23:59---20:00 min	7
19:59---16:00 min	9
15:59---13:00 min	11
12:59---11:30 min	13
under---11:30 min	15

2.5 Miles	
50:00 min or longer	1*
49:59---36:15 min	2 1/2
36:14---30:00 min	5
29:59---25:00 min	9
24:59---20:00 min	11 1/2
19:59---16:15 min	14

3.0 Miles	
1 hr or longer	1 1/2*
59:59---43:30 min	3
43:29---36:00 min	6
35:59---30:00 min	11
29:59---24:00 min	14
23:59---19:30 min	17
19:29---17:15 min	20
under---17:15 min	23

3.5 Miles	
1 hr 10:00 min or longer	1 1/2*
1 hr 9:59--50:45 min	3 1/2
50:44---42:00 min	7
41:59---35:00 min	13
34:59---28:00 min	16 1/2
27:59---22:45 min	20
22:44---20:10 min	23 1/2
under---20:10 min	27

4.0 Miles	
1 hr 20:00 min or longer	4*
1 hr 19:59--58:00 min	7
57:59---48:00 min	11
47:59---40:00 min	15
39:59---32:00 min	19
31:59---26:00 min	23
25:59---23:00 min	27
under---23:00 min	31

4.5 Miles	
1 hr 30:00 min or longer	4 1/2*
1 hr 29:59--1 hr 5:15 min	8
1 hr 5:14--54:00 min	12 1/2
53:59---45:00 min	17
44:59---36:00 min	21 1/2
35:59---29:15 min	26
29:14---25:55 min	30 1/2
under---25:55 min	33

5.0 Miles	
1 hr 40:00 min or longer	5*
1 hr 39:59--1 hr 12:30 min	9
1 hr 12:29--1 hr	14
59:59---50:00 min	19
49:59---40:00 min	24
39:59---32:30 min	29
32:29---28:45 min	34
under---28:45 min	39

6.0 Miles	
2 hrs or longer	6*
1 hr 59:59--1 hr 27:00 min	11
1 hr 26:59--1 hr 12:00 min	17
1 hr 11:59--1 hr	23
59:59---48:00 min	29
47:59---39:00 min	35
38:59---34:30 min	41
under---34:30 min	47

7.0 Miles	
2 hrs 20:00 min or longer	7*
2 hrs 19:59--1 hr 41:30 min	13
1 hr 41:29--1 hr 24:00 min	20
1 hr 23:59--1 hr 10:00 min	27
1 hr 9:59--56 min	34
55:59---45:30 min	41
45:29---40:15 min	48
under---40:15 min	55

8.0 Miles	
2 hrs 40:00 min or longer	8*
2 hrs 39:59--1 hr 56:00 min	15
1 hr 55:59--1 hr 36:00 min	23
1 hr 35:59--1 hr 20:00 min	31
1 hr 19:59--1 hr 4:00 min	39
1 hr 3:59--52:00 min	47
51:59---46:00 min	55
under---46:00 min	63

9.0 Miles	
3 hrs or longer	9*
2 hrs 59:59--2 hrs 10:30 min	17
2 hrs 10:29--1 hr 48:00 min	26
1 hr 47:59--1 hr 30:00 min	35
1 hr 29:59--1 h4 12:00 min	44
1 hr 11:59--48:30 min	53
58:29---41:45 min	62
under---51:45 min	71

10.0 Miles	
3 hrs 20:00 min or longer	10*
3 hrs 19:59--2 hrs 25:00 min	19
2 hrs 24:59--2 hrs	29
1 hr 59:59--1 hr 40:00 min	39
1 hr 39:59--1 hr 20:00 min	49
1 hr 19:59--1 hr 5:00 min	59
1 hr 4:59--57:30 min	69
under 57:30 min	79

*Exercise of sufficient duration to be of cardiovascular benefit. At this speed, ordinarily no training effect would occur. However, the duration is of such extent that a training effect does begin to occur.

Table 11.27[†] Supplemental point chart for other aerobic activities

CYCLING

2 Miles	Points
12 min or longer	0
11:59-8:00	1
7:59-6:00	2
Under 6:00	3

3 Miles	Points
18 min or longer	0
17:59-12:00 min	1 1/2
11:59-9:00	3
Under 9:00	4 1/2

4 Miles	Points
24 min or longer	0
23:59-16:00 min	2
15:59-12:00 min	4
Under 12:00 min	6

5 Miles	Points
30 min or longer	1*
29:59-20:00 min	2 1/2
19:59-15:00 min	5
Under 15:00 min	7 1/2

6 Miles	Points
36 min or longer	1*
35:59-24:00 min	3
23:59-18:00	6
Under 18:00	9

8 Miles	Points
48 min or longer	3 1/2*
47:59-32:00 min	6 1/2
31:59-24:00 min	10 1/2
Under 24:00 min	14 1/2

10 Miles	Points
60 min or longer	5 1/2*
59:59-40:00 min	8 1/2
39:59-30:00 min	13 1/2
Under 30:00 min	18 1/2

* Exercise of sufficient duration to be of cardiovascular benefit. At this speed, ordinarily no training effect would occur. However, the duration is of such extent that a training effect does begin to occur.

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Table 11.27 (con't)

SWIMMING

200 Yards	Points	600 Yards	Points
6:40 min or longer	0	20:00 min or longer	1 1/2*
6:39-5:00 min	1	19:59-15:00 min	4
4:59-3:20 min	1 1/2	14:59-10:00 min	5
Under 3:20 min	2 1/2	Under 10:00 min	7 1/2

300 Yards	Points	700 Yards	Points
10:00 min or longer	1*	23:20 min or longer	1 1/2*
9:59-7:30 min	1 1/2	23:19-17:30 min	4 1/2
7:29-5:00 min	2 1/2	17:29-11:40 min	6
Under 5:00 min	3 1/2	Under 11:40 min	8 1/2

400 Yards	Points	800 Yards	Points
13:20 min or longer	1*	26:40 min or longer	2 1/4*
13:19-10:00 min	2 1/2	26:39-20:00 min	5 3/4
9:59-6:40 min	3 1/2	19:59-13:20 min	7 1/4
Under 6:40 min	5	Under 13:20 min	10 3/4

500 Yards	Points	1000 Yards	Points
16:40 min or longer	1*	33:20 min or longer	4*
16:39-12:30 min	3	33:19-25:00 min	8 1/4
12:29-8:20 min	4	24:59-16:40 min	10 1/2
Under 8:20 min	6	Under 16:40 min	14 1/2

* Exercise of sufficient duration to be of cardiovascular benefit. At this speed, ordinarily no training effect would occur. However, the duration is of such extent that a training effect does begin to occur.

HANDBALL/BASKETBALL/SQUASH*

Duration	Points	Duration	Points
10	1 1/2	55	8 1/4
15	2 1/4	60	9
20	3	65	9 3/4
25	3 3/4	70	10 1/2
30	4 1/2	75	11 1/4
35	5 1/4	80	12
40	6	85	12 3/4
45	6 3/4	90	13 1/2
50	7 1/2		

* Continuous exercise. Do not include breaks, time-outs, etc.

Table 11.27 (con't)

STATIONARY RUNNING

	*60-70		*70-80		*80-90	
Time	Steps/Min	Points	Steps/Min	Points	Steps/Min	Points
2:30			175-200	3/4	200-225	1
5:00	300-350	1 1/4	350-400	1 1/2	400-450	2
7:30			525-600	2 1/4	600-675	3
10:00	600-700	2 1/2	700-800	3	800-900	4
12:30			785-1000	3 3/4	1000-1125	5
15:00	900-1050	3 3/4	1050-1200	4 1/2	1200-1350	6
17:30			1225-1400	6 1/4	1400-1575	8 1/2
20:00	1200-1400	7	1400-1600	8	1600-1800	10

* Count only when the left foot hits the floor. Feet must be brought at least eight inches from the floor.

ROPE SKIPPING

Minutes	Points
5	1 1/2
10	3
15	4 1/2

Skip with both feet together or step over the rope alternating one foot at a time.

VOLLEYBALL

Minutes	Points
15	1
30	2
60	4

WRESTLING

Minutes	Points
5	2
10	4
15	6

BENCH STEPPING (7 in step)

Stepping Rate (per min)	Time (min)	Points
30	6:30	1 1/2
	9:45	2 1/4
	13:00	3
35	6:00	2
	9:00	3
	12:00	4
40	5:00	2 1/2
	7:30	3 3/4
	10:00	5

Earlier in this chapter, cardiac rehabilitation was mentioned briefly. Although many of the guidelines and exercise prescriptions used in this chapter can be readily adapted for use in cardiac rehabilitation programs, officers with high risk of coronary heart disease or with diagnosed CHD should be exercised only after having an examination by a physician and according to his recommendations. Cardiac rehabilitation programs generally are conducted under the supervision of a medical doctor or highly trained paramedical team.

Programs for Muscular Strength and Endurance, and Flexibility

As described in Chapter 1, muscular strength and endurance are developed by using the overload principle, that is applying more tension on the muscle than is normally used. Muscular strength is best developed by using heavy weights (maximum tension applied) with few repetitions and muscular endurance by using lighter loads along with a greater number of repetitions. Actually both strength and endurance can be developed under each condition, but each system favors a more specific type of development.

Muscular strength and endurance can be developed by means of either isometric (static) or isotonic (going through the full range of motion) exercise. Although both types of training have their advantages and disadvantages, isotonic exercises are recommended for the development and maintenance of muscular strength and endurance. Isotonic exercises should be rhythmical, follow through the full range of motion, and not impede normal forced breathing. Lifting heavy weights impedes blood circulation and breathing and can be potentially dangerous for persons with high blood pressure, coronary heart disease, and other circulatory problems (10). Therefore, the use of lighter weights is recommended.

It has already been stated that the emphasis of the exercise prescription should be based on a good endurance conditioning program which is supplemented by an exercise routine to develop and maintain muscular strength, endurance, and flexibility. It is felt that this type of training program best meets the needs of police officers. Therefore, as an adjunct to the previously described aerobics program, a series of exercises to develop and maintain muscular strength, endurance, and flexibility for most of the major muscle groups of the body are outlined.

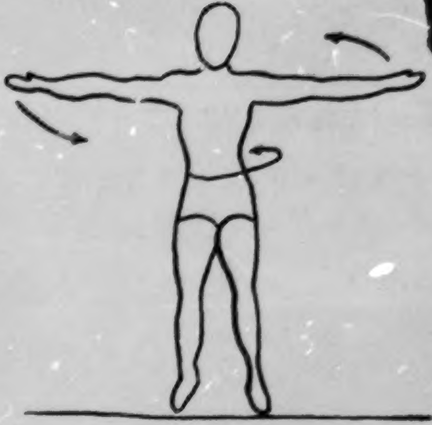
The exercise routines are divided into the following categories: upper body, trunk, and lower back stretching (1 through 6); leg stretching (7 through 12); and, muscular strength and endurance. Many of the exercises have several options from which to choose. In the first two categories (stretching exercises), some of the alternate exercises are more advanced and should be used only after the original exercise has been mastered. The muscular strength and endurance exercises offer options depending on whether or not weight training equipment is available.

The stretching exercises should be included as part of the warm-up routine prior to starting the aerobics phase of the program. The muscular strength and endurance routine can be used either after the stretching routine or after the aerobic phase.

Prior to starting the aforementioned routines, the participant should be familiar with the described starting position, movement, and suggested repetitions. The training load has been designed to give the participant a moderate amount of muscular strength and endurance. This is considered the safest and most sensible manner to approach flexibility and muscular strength and endurance training.

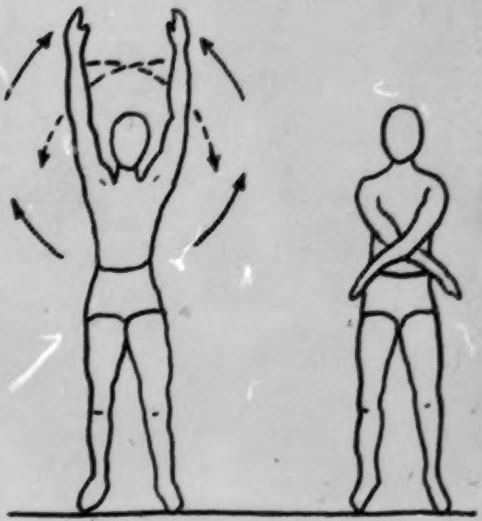
To help avoid muscle soreness in weight training exercises, the starting ght should be light (approximately 50 percent of maximum that can be lifted one repetition). After a few weeks of training, 60 to 70 percent of maximum can be attained. As soon as the required number of repetitions can be easily managed, more weight can be added. This is usually accomplished by adding 5 pounds of weight for arm and 10 pounds for leg exercises. For those participants who want to place more emphasis on strength development, a different training load and added sets would be necessary. The texts by Rasch (16) or Hooks (7) are recommended for more advance weight training programs.

UPPER BODY, TRUNK, AND LOWER BACK STRETCHING EXERCISES



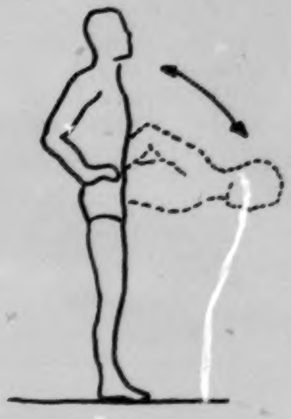
1. Trunk Rotation

Purpose: To stretch muscles in the back, sides, and shoulder girdle.
Starting Position: Stand astride with feet pointed forward; raise arms to shoulder level. May use bar to increase stretch to the deltoid muscle and waist.
Movement: Twist trunk to the right; avoid lifting heels. Repeat 3 to 4 times before twisting to left side.
Repetitions: 10



2. Double Arm Circles and Toe Raises

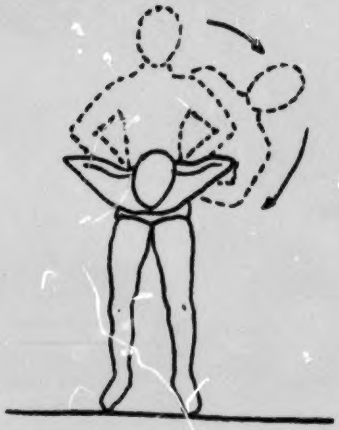
Purpose: To stretch muscles of the shoulder girdle and to strengthen muscles of the feet.
Starting Position: Stand with feet about 12 inches apart and arms at sides.
Movement: Swing arms upward and around, making large circles. As arms are raised and crossed overhead, rise on toes.
Repetitions: 10 to 15



3A. Forward Bend

Purpose: To stretch muscles of the buttocks and posterior leg.
Starting Position: Stand astride with hands on hips.
Movement: Slowly bend forward to a 90 degree angle; return slowly to starting position; keep back flat.
Repetitions: 10

3B. Abdominal Churn

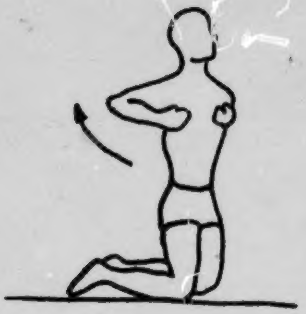


Purpose: To stretch muscles of the buttocks, abdomen, and posterior leg.
Starting Position: Stand astride with hands on hips.
Movement: Lower trunk sideward to left; rotate to forward position and to right; return to upright position. Repeat and reverse direction after 2 rotations.
Repetitions: 5 to 8

3C. Bar Hang

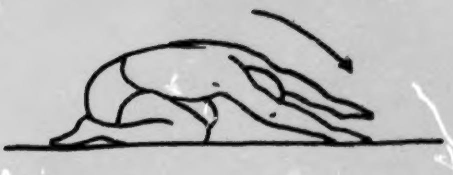
Purpose: To stretch muscles of arms, shoulders, back, trunk, hips, and pelvic regions. Good general body stretcher.
Starting Position: Hang from bar with arms straight.
Repetitions: 1 for up to 60 seconds

4. Shoulder and Chest Stretch



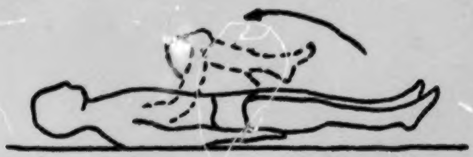
Purpose: To stretch muscles of the chest and shoulders.
Starting Position: Stand astride or kneel with arms at shoulder level and elbows bent.
Movement: Slowly force elbows backward and return to starting position.
Repetitions: 10 to 15

5A. Lower Back Stretch



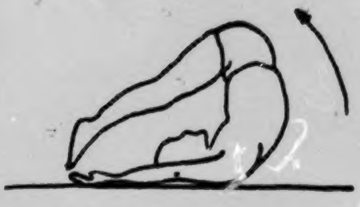
Purpose: To stretch muscles in the lower back.
Starting Position: Crouch on hands and knees.
Movement: Slowly rock back until buttocks touch heels; emphasize rounding back; return to starting position.
Repetitions: 10

5B. Alternate Lower Back Stretch



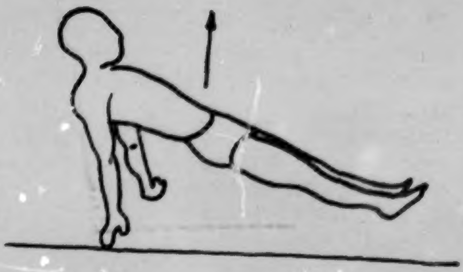
Purpose: To stretch muscles in the lower back and buttocks.
Starting Position: Lie on back with the legs extended or stand erect.
Movement: Lift and bend one leg; grasp the knee and keep the opposite leg flat: pull knee to chest. Repeat with alternate leg.
Repetitions: 10

5C. Advanced Lower Back and Hamstring Stretch



Purpose: To stretch muscles of the lower back and hamstring muscles.
Starting Position: Lie on back with legs bent.
Movement: Keep knees together and slowly bring them over the head; straighten the legs and touch the toes to the floor; return to starting position.
Repetition: 5 to 10

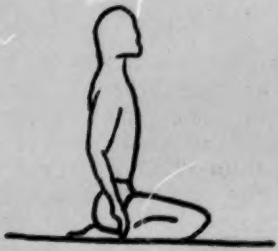
6. Inverted Stretch



Purpose: To stretch and strengthen the anterior hip, buttocks, and abdominal muscles.
Starting Position: Sit with arms at side.
Movement: Support body with heels and arms and raise trunk as high as possible.
Repetitions: 10

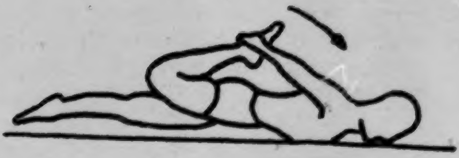
LEG STRETCHING EXERCISES

7A. Front Leg Stretch



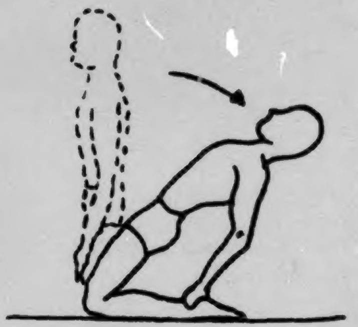
Purpose: To stretch the muscles in the anterior leg.
Starting Position: Kneel with tops of ankles and feet flat on the ground.
Movement: Lean backward slowly; keep the back straight; maintain tension on muscles for 30 to 60 seconds.
Repetitions: 1 to 2

7B. Front Leg Stretch



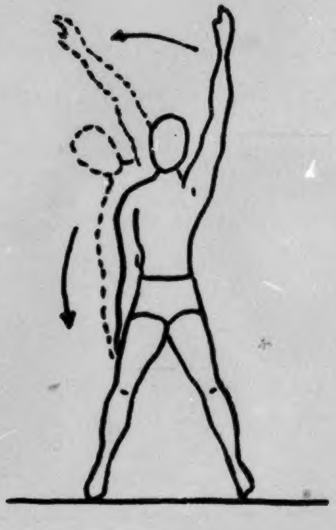
Purpose: To stretch the muscles of the anterior thigh and hip.
Starting Position: Lie on the ground with face down or stand erect.
Movement: Pull the ankle to the hip slowly; hold for 3 counts and release the ankle. Use same procedure for other side.
Note: If difficulty is encountered in assuming starting position, ask for assistance.
Repetitions: 5 to 10

7C. Advanced Front Leg Stretch



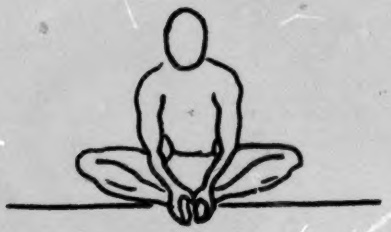
Purpose: To stretch the muscles of the anterior thigh.
Starting Position: Kneel with feet turned outward.
Movement: Lean backward slowly; put constant tension on muscles; use arms to control the movement; hold backward position for 30 to 60 seconds.
Repetitions: 1 to 2

8. Side Stretch



Purpose: To stretch the medial muscles of the thigh and the lateral muscles of the trunk and thorax.
Starting Position: Stand erect with one arm extended upward and the other relaxed at the side; place feet apart at more than shoulder width.
Movement: Bend trunk directly to the right with the left arm stretching overhead; keep both feet flat. Use same procedure for other side.
Repetitions: 5 to 10

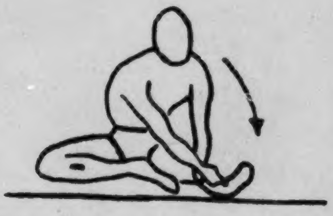
9. Groin Stretch



Purpose: To stretch the groin muscles.
Starting Position: Sit with knees bent outward and the bottoms of the feet together.
Movement: Grasp ankles and pull the upper body as close as possible to the feet. Hold stretch for 30 to 60 seconds. Repeat with other leg.
Repetitions: 1 to 2

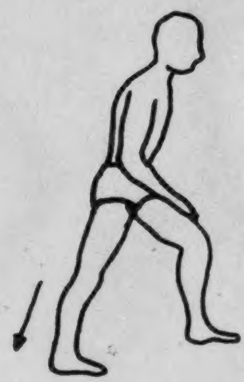
10. Hamstring Stretch

Purpose: To stretch the muscles in the posterior leg and thigh.
Starting Position: Sit on ground with one leg extended straightforward; place the other leg forward with the knee bent and the sole touching the inner thigh of the extended leg.
Movement: Bend forward and attempt to touch the head to the knee; hold stretch for 30 to 60 seconds. Repeat with other leg.
Repetitions: 1 to 2



11A. Calf Stretcher

Purpose: To stretch the posterior leg and ankle muscles.
Starting Position: Stand in forward stride position with the forward knee partially flexed and the rear leg fully extended; keep feet pointed forward and heels flat on the ground.
Movement: Lean trunk forward until a continuous stretch occurs in the rear calf; hold stretch for 30 to 60 seconds. Repeat with other leg.
Repetitions: 1 to 2



11B. Calf Stretcher

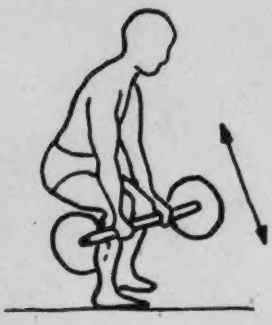
Purpose: To stretch the posterior leg muscles.
Starting Position: Stand in upright position with the balls of the feet on the edge of a step.
Movement: Slowly lower heels and hold for 30 to 60 seconds; raise heels and rise on toes.
Repetitions: 1 to 2

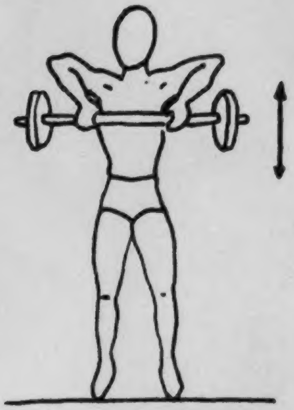
MUSCULAR STRENGTH AND ENDURANCE EXERCISES

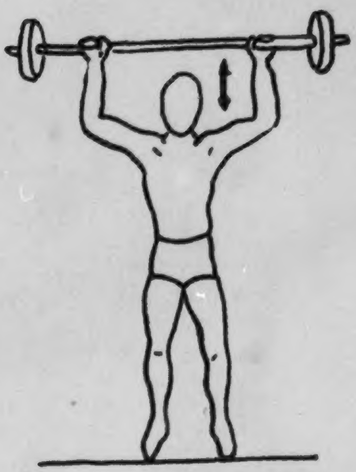
Two options will be illustrated for each of the following routines. The first option (A) will utilize weights; the second (B) stresses the same muscle group, but without utilizing weights.

12A. Weight Training Warm-Up

Purpose: To utilize all of the major muscle groups in a warm-up routine prior to concentrating on specific muscle groups.
Starting Position: Place feet astride; bend knees; keep back straight; hold a bar with an overhand grip. (Position A)
Movement: Straighten legs with back still straight; raise elbows to shoulder height or higher (Position B); lower elbows next to the trunk and keep the weight at chest level; press the weight over the head and fully extend arms (Position C); return weight to floor.
Repetitions: 8 to 10

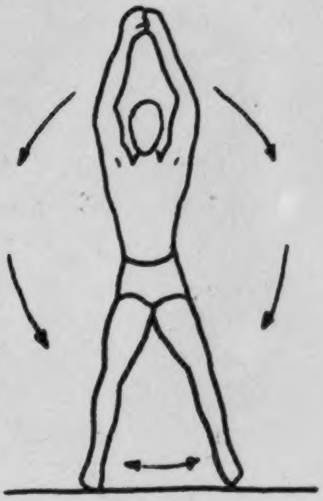

Position A


Position B


Position C

12B. Jumping Jacks

Purpose: To utilize all of the major muscle groups in a warm-up routine prior to concentrating on specific muscle groups.
Starting Position: Stand erect with feet together and arms at the side.
Movement: Swing arms upward until over head and spread feet apart in one movement; in second movement, return to starting position.
Repetitions: 20

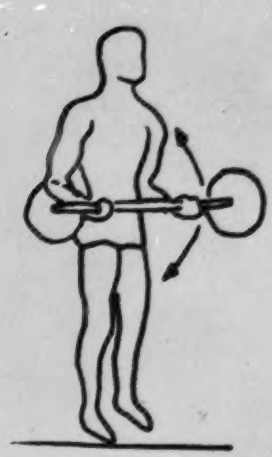


13. Military Press

Purpose: To strengthen the shoulder, upper back, and arm muscles.
Starting Position: Support weight at shoulder level with an overhead grip.
Movement: Push weight directly overhead; keep the back and knees straight; return the weight slowly to starting position.
Repetitions: 10 to 12

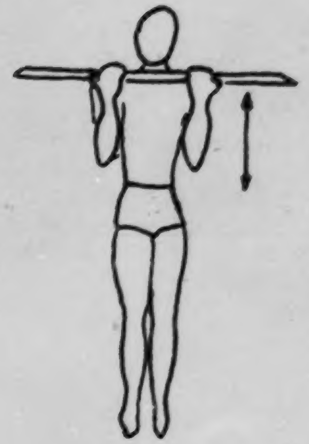
14A. Curl

Purpose: To strengthen the anterior arm muscles.
Starting Position: Hold weight with a palms-up grip; keep arms straight.
Movement: Bend arms and bring weight up to chest; return slowly.
Repetitions: 10 to 12

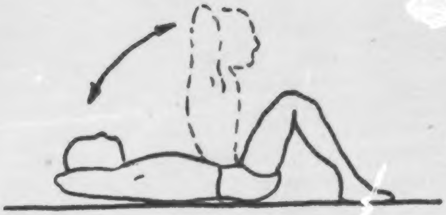


14B. Pull-Up

Purpose: To strengthen the anterior arm, upper back, and shoulder muscles.
Starting Position: Place hands about 18 inches apart on overhead bar with either a palms-in or a palms-out grip; keep arms straight in order to support the body.
Movement: Pull body up so chin comes above the bar; slowly lower the body to starting position.
Repetitions: Progress to 10 to 15

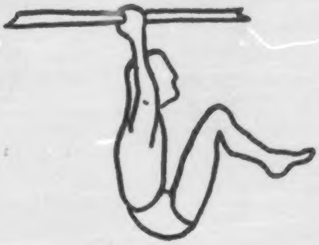


15A. Sit Up



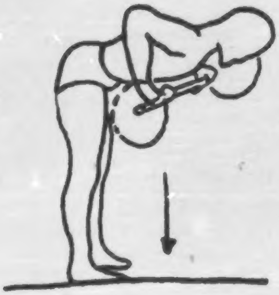
Purpose: To strengthen the abdominal and hip flexor muscles.
Starting Position: Lie on back with knees bent and hands clasped under head or holding weight on chest.
Movement: Raise head and trunk to an upright position; hold position for 3 counts; slowly return to starting position. Emphasize a roll-up type movement.
Repetitions: 15 to 20

15B. Leg Pull-Up



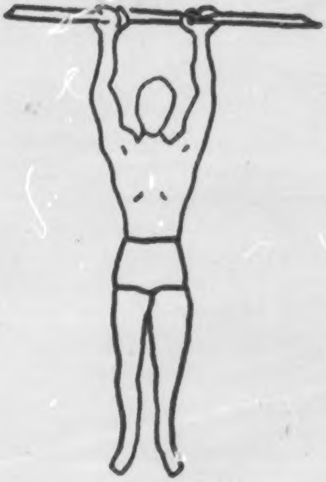
Purpose: To strengthen the abdominal and hip flexor muscles.
Starting Position: Hang from bar with body straight.
Movement: Bend knees slowly; bring knees to chest; return slowly to starting position.
Repetitions: Progress to 10 to 15

16A. Bent-Over Rowing



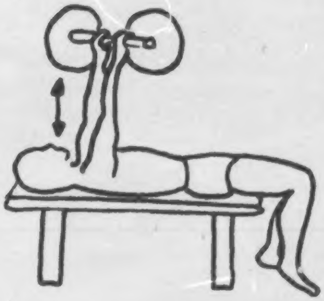
Purpose: To strengthen the mid to upper back and posterior arm muscles.
Starting Position: Stand with feet apart slightly more than shoulder width; bend forward at waist with back straight and legs slightly bent; keep arms straight to support the weight.
Movement: Raise weight to chest and return it slowly to starting position.
Repetitions: 10 to 12

16B. Pull-Up Wide Grip



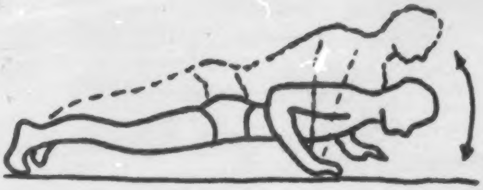
Purpose: To strengthen the mid to upper back and the posterior and anterior arm muscles.
Starting Position: Place hands about 36 inches apart on overhead bar with either a palms-in or palms-out grip; hang from the bar with arms straight to support the body.
Movement: Pull body up so chin comes above the bar; slowly lower the body to starting position.
Repetitions: Progress to 10 to 15

17A. Supine Press



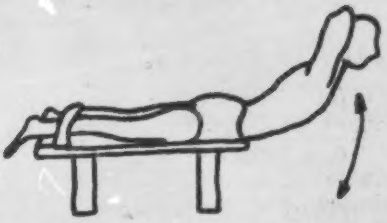
Purpose: To strengthen the chest, anterior shoulder, and posterior arm muscles.
Starting Position: Lie on back on a bench 10 to 14 inches wide; use an overhand grip on a weight supported on standards or held by two assistants; keep arms straight.
Movement: Slowly lower weight to touch the chest; raise weight until arms are straight.
Repetitions: 10 to 12

17B. Push-Ups



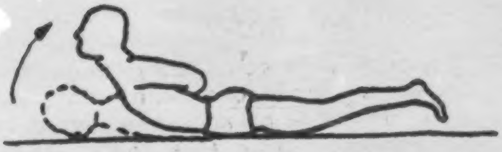
Purpose: To strengthen the chest, anterior shoulder, and posterior arm muscles.
Starting Position: lie on stomach with hands flat on floor and positioned beneath the shoulders.
Movement: Push entire body except feet and hands off the floor until the arms are straight; lower body until chin touches floor.
Note: Positioning the hands beyond the shoulders or putting blocks beneath the hands increases the stretch of the pectorals.
Repetitions: Progress to 20 to 30

18A. Back Hyperextension



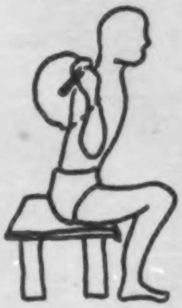
Purpose: To strengthen the lower back muscles.
Starting Position: Lie on a bench with the face down; extend the body from above the waist over the edge of the bench; strap or hold the feet to the other end of the bench.
Movement: Lift head and trunk; slowly lower head and trunk.
Note: Do not hyperextend.
Repetitions: Progress to 10 to 15.

18B. Back Tightener



Purpose: To strengthen the lower back muscles.
Starting Position: Lie on floor with face down; fold hands over lower back area.
Movement: Raise head and chest and tense the gluteal and lower back muscles.
Caution: Do not hyperextend; just raise head and chest slightly off the floor; concentrate mainly on tensing gluteal muscles.
Repetitions: 10 to 15

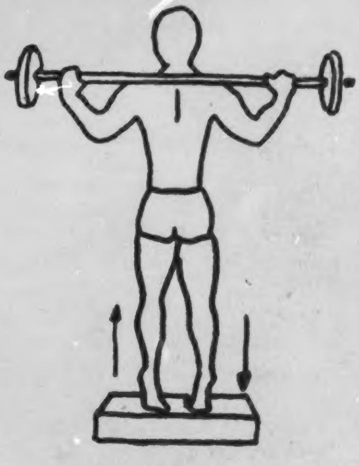
19. Squat



Purpose: To strengthen the anterior thigh and buttock muscles.
Starting Position: Stand erect with feet astride and support weight on shoulders with palms-up grip.
Movement: Keep the back straight and bend knees into a squat position; return to the standing position.
Note: Do half squat if knees are weak.
Repetitions: 10 to 12

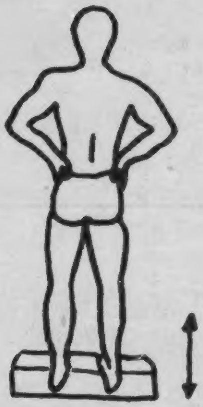
20A. Heel Raises

Purpose: To strengthen the calf muscles.
Starting Position: Place feet astride and hold weight on shoulders with a palms-up grip.
Movement: Raise to a toe position; lower body.
Note A board may be placed under the toes to increase the range of motion.
Repetition: 10 to 15



20B. Heel Raises

Purpose: To strengthen the calf muscles.
Starting Position: Place feet astride and use arms for balance if necessary.
Movement: Raise to a toe position; lower body.
Note: A board may be placed under the toes to increase the range of motion.
Repetition: 10 to 15



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IMPLEMENTATION EXPERIENCES IN OTHER SETTINGS:
BUSINESS AND INDUSTRY

Another segment of the present project consisted of an examination of the types of physical fitness programs available to employees of various businesses and industries. Due to the limitations of the current project, it was not possible to conduct a totally comprehensive or detailed review of business and/or industrial settings. Nevertheless, it was felt that such an examination as was possible might reveal different types of programs which have been successful in nonpolice employment situations and which might promise adaptability to police agencies.

To this end, a letter requesting available information on current programs was sent to selected members of the American Association of Fitness Directors in Business and Industry (AAFDBI), identified with the assistance of the President's Council on Physical Fitness. A number of responses were received. Since, however, one emphasis here is on current programs, this chapter will focus on those responses from organizations in which fitness programs are operational. It should be noted that other very helpful responses were received from organizations still in the planning and development stages of their programs.

Five businesses provided detailed descriptions of their physical fitness programs for employees; these programs are outlined briefly in Table 12.1. Not all of these five companies provided the same kinds of information, thus, some of the areas in the table are blank.

It can be seen that, in terms of content, facilities, and equipment, these programs are quite similar to those reported by police agencies which have been described elsewhere in this report. These programs generally emphasize cardiovascular functioning and/or sports programs using in-house facilities and a great variety of equipment. In fact, the equipment provided for employees of these organizations represent much greater variety and scope than is typically found in police agencies. This is not an unexpected result, however, due to the greater financial resources of these companies in comparison to the resources available to police agencies. Two of the respondents estimated expenses of approximately $10,000.

Circuit training, mentioned by three of the five companies, is a concept not found in police agency physical fitness programs. This type of training represents a combination of medical measurement and physical activity individually prescribed for each participant. Various cardiovascular measurements (e.g., pulse rate) are taken before actual participation begins. Participants then progress through a series of activities such as the jogging-rowing-bicycling-situp scheme utilized by Metropolitan Life. Each activity is performed for a predetermined period of time (e.g., two minutes jogging, one minute rowing, etc.) which has been established on an individual basis for each participant by the program leader. Cardiovascular measures are taken at the end of each stage of physical activity and during a resting period at the end of the circuit. A variation of this scheme is utilized by Ashland Oil; this program provides nine or ten different stations in the circuit in which every other activity is designed to stimulate 75% to 85% maximum pulse rate. These programs represent a unique design for combining different physical activity in such a way as to prevent boredom and to maintain control over the amount of exercise an individual performs during a given time period.

These companies also provide full-time instructors who are experienced physical therapists or athletic directors, as well as continuing assistance from medical personnel.

Although the programs are voluntary, as are police agency physical fitness programs, participation rates are much higher than those reported by police agencies. Two of the organizations reported consistent participation by approximately one-third of their employees. It should, perhaps, be noted here for clarification, that these programs are described for home-based or headquarters personnel only, e.g., those employed in the New York City office.

The area of special features, however, particularly differentiates these programs from those described by police agencies. The emphasis on individual prescription and individualized instruction is apparent for business fitness programs. In addition, several companies indicated that regular participation during working hours is available and, indeed, encouraged. Provisions for special counseling and/or therapeutic sessions during regular working hours were also indicated. And, finally, coeducational participation in some of the physical fitness activities was indicated by several companies.

In connection with this final point, a study conducted by the representative of Ashland Oil, who responded to the letter requesting information, yielded some interesting results (1). This small sample study found, in part, that coeducational programming did not present difficulties to responding organizations. Of 18 companies permitting coeducational membership in fitness programs, 10 indicated either the absence of any problems or the improbability of any problems developing. The major problem mentioned by the other companies concerned the provision of separate dressing facilities.

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One response not included in Table 12.1 came from the Department of Leisure Services of the Corporation of the Township of Richmond in British Columbia. As this is a governmental division providing public services, it is not properly a business or industry, but it is worth discussing because of the extent of programming available to the public. A variety of fitness-related programs and classes are provided year-round; these include jogging, fitness courses and weight training courses. All include instruction in proper exercising technique, and all are administered in convenient geographical locations. Beginning and advanced co-educational "keep fit" classes, for example, are taught in local schools, which combine jogging with exercise stations. One of the most interesting programs consists of four specially designed jogging courses which have been built on grass surfaces (to decrease the possibility of shin splints) in natural settings.

It can be seen, then, that diversity in physical fitness programming has been achieved by some businesses and organizations. Although data on the effectiveness of these programs are not available, all five companies included in Table 12.1 indicated that evaluative studies are in progress. These studies will examine both statistical data on absenteeism and productivity, as well as more impressionistic and attitudinal data concerning employee morale and motivation.

Finally, Marcia Fein, Health Fitness Coordinator for the General Foods Corporation in White Plains, New York, provided some "helpful hints" for developing physical fitness programs. These are listed below:

1. Clarify your philosophy: it is important to establish a clear set of goals for health and fitness which will, in turn, give direction and purpose to the program.

2. Create a strong bond between the medical and fitness divisions: needless to say, it is necessary to devise safe procedures for screening, stress testing, and profiling individuals above and below 35 years of age.

3. Provide education: it is necessary to develop an understanding of fitness at all levels of the company structure in order to nurture support and participation. It has been our experience that successful educational sessions have included information on the physical, mental, and emotional benefits of fitness, the analysis of risk factors, and the explanation of various relaxation techniques.

4. Seek support in upper management: for corporate leaders to be interested in such ventures, they must see an eventual return on their initial investment. Thus, it may be useful to suggest payback in terms of decreases in absenteeism, improvement in individual productivity (although, as yet, we do not have conclusive evidence to substantiate these contentions) and a decrease in the power-drain resulting from the loss or disability of highly trained employees.

5. Establish high standards: it is necessary to remember that when functioning within the business realm, the fitness program and its leaders must suit the criteria established for success in the fields of both business and fitness. For, undoubtedly a loosely defined program will serve to reinforce the belief that fitness is a low priority endeavor not worthy of inclusion in a successful business person's schedule.

6. Consider professional preparation: the tone of the program is greatly influenced by the education, experience, personality and motivation of its leaders. Therefore, salaries should be structured to attract such professionals.

7. Choose the program design which is in keeping with your philosophical objectives: the two most common are as follows: (1) the individual-centered program, whereby the person works, independently, to achieve his goals, usually going through a prescribed series of stations in a circuit training room; or (2) the instructor-lead group-oriented program in which individuals are encouraged to work together toward the achievement of their own goals. It is, thus, understandable that our motivational objective to maintain both interest and attendance may provide the impetus for not only our group-oriented class structure, but also the variety of programs we intend to offer.

Table 12.1 Physical Fitness Programs in Business/Industry

Name	Year Begun	Content	Instructor	Participation Rate	Voluntary or Mandatory	Facilities	Equipment	Special Features
Ashland Oil (Kentucky)		Progressive circuit interval program Sports	Full-time supervisor			In-house gymnasium	Treadmill/Universal Gym/Exercycles/ Rowing Machines/ Barbells/Dumbbells/ Punching bag/Medicine balls/Tumbling mats/ Handball, racquet ball, etc. equipmt	Individual perscriptions are written for each participant Standards of qualification exist for members Emphasis is on regularity and health maintenance Facilities are sex segregated
Chase Manhattan Bank (New York City)	1975	Cardiovascular fitness	Medical department		Mandatory			Pre-participation medical screening is required Orientation lectures and periodic testing provided Individual prescriptions are written
Forbes Magazine (New York City)		Individual circuit training Weight/figure control Yoga	Full-time licensed athletic director	1/3 employees	Voluntary	In-house rooftop facilities	Treadmill/Abdominal board/Jump ropes/ Wall pulleys/Monarch bicycle/Medicine balls/Rowing machine/ Thigh-knee weights/ Dumbbells/Floor press machine/ Exercise bench/Speed bag/Varieties of sports equipment	Roof facilities contain a multi-purpose court, golf driving range and lunch area Participation is co-educational Participation during working hours is encouraged
Metropolitan Life (New York City)	1968	Four-station circuit Sports Exercise to music	3 physical education majors	1,000 employees/wk	Voluntary	In-house gymnasium	4 station - jogging/rowing/ bicycling/situps Many varieties of sports equipment	Employees participate during working hours Therapeutic sessions are provided during working hours Consultation on diet and nutrition is provided

Table 12.1 (con't.)

Name	Year Begun	Content	Instructor	Participation Rate	Voluntary or Mandatory	Facilities	Equipment	Special Features
Pepsico (New York)	1951	Jogging Aerobic dancing Yoga Sports Walking	Physical fitness therapist Physician	1/3 employees consistent 1/3 sporadic 1/3 no interest	Voluntary	In-house and outdoors facilities	Treadmill/ Universal gym/ Striking bag/ Stationary bicycle/ Sauna/Whirlpool/ 1.5 mile Track	Individual sets own goals and rate of progress in consultation with instructor Special facilities are available for special needs (e.g., weight control, medical condition)

REFERENCES

1. Stapf, David J. A poll of forty major industries concerning exercise facilities and membership policies. July 1, 1976.

APPENDICES

APPENDIX A

MEDICAL HISTORY QUESTIONNAIRE

MEDICAL HISTORY QUESTIONNAIRE

Institute for Aerobics Research
11811 Preston Road
Dallas, Texas 75230

This is your medical history form for your visit to The Institute for Aerobics Research. All information will be kept confidentail. The doctor or exercise physiologist you see at the Institute will use this information in his evaluation of your health. You will want to make it as accurate and complete as possible, yet free of meaningless details. Please fill out this form carefully and thoroughly. Then check it over to be sure you haven't left out anything.

Note: Please print all responses so that your data will be compatible with computer storage and analysis.

THE AEROBICS CENTER
DALLAS, TEXAS

Name ______________________ Exam Date ______________, 19 ____

When dates are required, please use numbers to represent the months as follows:

January	.01
February	.02
March	.03
April	.04
May	.05
June	.06
July	.07
August	.08
September	.09
October	.10
November	.11
December	.12

For addresses, please use the official Post Office two-letter abbreviations listed below.

Abbreviations for States (and Territories)

AL	Alabama
AK	Alaska
AZ	Arizona
AR	Arkansas
CA	California
CZ	Canal Zone (Panama)
CO	Colorado
CT	Connecticut
DE	Delaware
FL	Florida
GA	Georgia
GU	Guam
HI	Hawaii
ID	Idaho
IL	Illinois
IN	Indiana
IA	Iowa
KS	Kansas
KY	Kentucky
LA	Louisiana
ME	Maine
MD	Maryland
MA	Massachusetts
MI	Michigan
MN	Minnesota
MS	Mississippi
MO	Missouri
MT	Montana
NE	Nebraska
NV	Nevada
NH	New Hampshire
NJ	New Jersey
NM	New Mexico
NY	New York
NC	North Carolina
ND	North Dakota
OH	Ohio
OK	Oklahoma
OR	Oregon
PA	Pennsylvania
PR	Puerto Rico
RI	Rhode Island
SC	South Carolina
SD	South Dakota
TN	Tennessee
TX	Texas
UT	Utah
VT	Vermont
VA	Virginia
VI	Virgin Islands
WA	Washington (state)
DC	Washington, D. C.
WV	West Virginia
WI	Wisconsin
WY	Wyoming

Institute for Aerobics Research
11811 Preston Road
Dallas, Texas 75230

Patient Medical History Form

DO NOT WRITE IN THIS SPACE: FOR OFFICE USE ONLY.

PATIENT NUMBER	VISIT	CARD		FORM		CLINIC
		0 1	M	0	2	8

All information is private and confidential. Please Print.

I. GENERAL INFORMATION

☐ Mr. ☐ Ms. ☐ Miss ☐ Mrs. ☐ Dr.

NAME ________ FIRST ________ MIDDLE ________ LAST

ADDRESS

________ NUMBER AND STREET

02 ________ CITY ________ STATE ________ ZIP CODE

________ COUNTRY (IF OUTSIDE U.S.A.)

HOME PHONE (____) ____ – ____ AREA CODE

SOCIAL SECURITY NUMBER ____ – ____ – ____

DATE OF BIRTH 03 ____ MONTH DAY YEAR

TODAY'S DATE ____ MONTH DAY YEAR

FAMILY PHYSICIAN

Dr. ________ FIRST NAME, IF KNOWN ____ INITIAL ________ LAST NAME

DOCTOR'S ADDRESS (if known)

________ NUMBER AND STREET

04 ________ CITY ________ STATE ________ ZIP CODE

PHONE (____) ____ – ____ AREA CODE

May we send a copy of your consult to your physician? Yes ☐ No ☐

MARITAL STATUS

Single ☐ Married ☐ Divorced ☐ Widowed ☐ Separated ☐

SEX

Male ☐ Female ☐ PRESENT AGE ☐☐☐

EDUCATION (Check highest level attained)

☐ Grade School

☐ Junior High School

☐ High School

☐ Two-year College (or 4-year college; degree not completed)

☐ College Graduate

☐ Postgraduate School

OCCUPATION

____

FOR OFFICE USE ONLY
OCCUP CODE ☐

EMPLOYER (use abbreviations if necessary)

05 ________

EMPLOYER'S ADDRESS

________ NUMBER AND STREET

06 ________ CITY ________ STATE ________ ZIP CODE

BUSINESS PHONE (____) ____ – ____ AREA CODE

What is/are your purpose(s) in coming to the Institute?

☐ To participate in a research study.

☐ To determine my current level of physical fitness and to receive recommendations for an exercise program.

☐ Other (please explain): ________

07 ________

____

____

PLEASE PRINT

Medical History

DO NOT WRITE IN THIS SPACE! FOR OFFICE USE ONLY.

PATIENT NUMBER	VISIT	CARD		FORM		CLINIC
		1	0	M	0 2	B

PRESENT HISTORY

Check the box in front of those questions to which your answer is yes. Leave others blank.

10
- ☐ Has a doctor ever said that your blood pressure was too high or too low?
- ☐ Do you ever have pain in your heart or chest?
- ☐ Are you often bothered by a thumping of the heart?
- ☐ Does your heart often race like mad?
- ☐ Do you ever notice extra heart beats or skipped beats?
- ☐ Are your ankles often badly swollen?
- ☐ Do cold hands or feet trouble you even in hot weather?
- ☐ Has a doctor ever said that you had or have heart trouble, an abnormal electrocardiogram (ECG or EKG), heart attack, or coronary?
- ☐ Do you suffer from frequent cramps in your legs?
- ☐ Do you often have difficulty breathing?
- ☐ Do you get out of breath long before anyone else?
- ☐ Do you sometimes get out of breath when sitting still or sleeping?
- ☐ Has a doctor ever told you your cholesterol level was high?

Comments: 11 ______________________ 12 ______________________ 13 ______________________

Do you now have or have you recently had:

14
- ☐ A chronic, recurrent or morning cough?
- ☐ Any episode of coughing up blood?
- ☐ Increased anxiety or depression?
- ☐ Problems with recurrent fatigue, trouble sleeping or increased irritability?
- ☐ Migraine or recurrent headaches?
- ☐ Swollen or painful knees or ankles?
- ☐ Swollen, stiff or painful joints?
- ☐ Pain in your legs after walking short distances?
- ☐ Back pain?
- ☐ Kidney problems such as passing stones, burning, increased frequency, decreased force of stream of difficulty in starting or stopping your stream?
- ☐ Prostate trouble (men only)?
- ☐ Any stomach or intestinal problems such as recurrent heartburn, ulcers, constipation or diarrhea?
- ☐ Any significant vision or hearing problem?
- ☐ Any recent change in a wart or mole?
- ☐ Glaucoma or increased pressure in the eyes?
- ☐ Exposure to loud noises for long periods?

Comments: 15 ______________________

WOMEN ONLY answer the following:

16
- ☐ Do you have any menstrual period problems?
- ☐ Do you have problems with recurrent itching or discharge?
- ☐ Did you have any significant childbirth problems?
- ☐ Do you have any breast discharges or lumps?
- ☐ Do you sometimes lose urine when you cough, sneeze or laugh?

Please give number of: Pregnancies ____ Living children ____ First day of last menstrual period ____ MONTH DAY YEAR

Date of last pelvic exam and/or Paps smear: month ____ year 19 ____ Results: Normal ☐ Abnormal ☐

Comments: 17 ______________________

PLEASE PRINT

Medical History

DO NOT WRITE IN THIS SPACE: FOR OFFICE USE ONLY.

PATIENT NUMBER	VISIT	CARD		FORM		CLINIC
		2	5	M	0 2	8

MEN and WOMEN answer the following:

List any prescribed medications you are now taking:

25 ______________________________

____

List any self-prescribed medications or dietary supplements you are now taking:

26 ______________________________

____

27

Date of last complete physical examination:	____ month	19 ____ year	never ☐	can't remember ☐	Normal ☐	Abnormal ☐
Date of last chest x-ray:	____ month	19 ____ year	never ☐	can't remember ☐	Normal ☐	Abnormal ☐
Date of last electrocardiogram:	____ month	19 ____ year	never ☐	can't remember ☐	Normal ☐	Abnormal ☐
Date of last dental check-up:	____ month	19 ____ year	never ☐	can't remember ☐	Normal ☐	Abnormal ☐

List any other medical or diagnostic test you have had in the past two years:

28 ______________________________

____

29 ______________________________

____

List hospitalizations including dates of and reasons for hospitalization:

30 ______________________________

____

31 ______________________________

____

32 ______________________________

____

List any drug allergies:

33 ______________________________

____

PAST HISTORY

Have you ever had:

34

- ☐ Heart Attack, how many years ago?_____
- ☐ Rheumatic Fever
- ☐ Heart murmur
- ☐ Diseases of the arteries
- ☐ Varicose veins
- ☐ Arthritis of legs or arms
- ☐ Diabetes or abnormal blood sugar test
- ☐ Phlebitis
- ☐ Dizziness or fainting spells
- ☐ Epilepsy or fits
- ☐ Strokes
- ☐ Diphtheria
- ☐ Scarlet fever
- ☐ Infectious mononucleosis
- ☐ Anemia
- ☐ Thyroid problems
- ☐ Pneumonia
- ☐ Bronchitis
- ☐ Asthma
- ☐ Abnormal chest x-ray
- ☐ Other lung diseases
- ☐ Injuries to back, arms, legs or joints
- ☐ Broken bones
- ☐ Jaundice or gallbladder problems
- ☐ Polio
- ☐ Urinary tract infections, kidney stones, or prostate problems.
- ☐ Any nervous or emotional problems

Comments:

35 ______________________________

____

PLEASE PRINT

Medical History

DO NOT WRITE IN THIS SPACE: FOR OFFICE USE ONLY

PATIENT NUMBER	VISIT	CARD		FORM	CLINIC
		4 0	M	0 2	B

FAMILY MEDICAL HISTORY

40 **FATHER:** Alive ☐ Deceased ☐ Current age ___ Age at death ___ General health now: excellent ☐ good ☐ fair ☐ poor ☐ don't know ☐
Cause of death or reason for poor health now: ______________________________

MOTHER: Alive ☐ Deceased ☐ Current age ___ Age at death ___ General health now: excellent ☐ good ☐ fair ☐ poor ☐ don't know ☐
Cause of death or reason for poor health now: ______________________________

41 **SIBLINGS:** No. of brothers ___ No. of sisters ___ Age range ___ – ___ Health Problems: ______________________________
____

42 **FAMILIAL DISEASES:** Have any of your blood relatives had any of the following? Include grandparents, aunts, and uncles, but exclude cousins, relatives by marriage, and half relatives.

- ☐ Heart attacks under age 50
- ☐ Strokes under age 50
- ☐ High blood pressure
- ☐ Elevated cholesterol
- ☐ Diabetes
- ☐ Asthma or hay fever
- ☐ Congenital heart disease
- ☐ Heart operations
- ☐ Glaucoma
- ☐ Obesity (20 or more lbs. overweight)
- ☐ Leukemia or cancer under age 60

Comments: ______________________________
____

43

OTHER HEART DISEASES RISK FACTORS

44 **SMOKING**

Have you ever smoked cigarettes, cigars or a pipe? yes ☐ no ☐

If no, skip to Diet section.

Do you smoke presently? yes ☐ no ☐

If you did or do smoke cigarettes, how many per day? ___ Age you started: ___

If you did or do smoke cigars, how many per day? ___ Age you started: ___

If you did or do smoke a pipe, how many pipefuls per day? ___ Age you started: ___

If you have quit smoking, when was it? ___ Month 19___ Year

45 **DIET**

What do you consider a good weight for yourself? ___ pounds

What is the most you have ever weighed? (including when pregnant) ___ lbs. At what age? ___ yrs.

Weight: Now ___ lbs. One year ago ___ lbs. At age 21 ___ lbs.

Number of meals you usually eat per day. ☐

Average number of eggs you usually eat per week: ___ (Do not count those in cooking and baking, cakes, casseroles, etc.)

Number of times per week you usually eat:

Beef ___
Pork ___
Fish ___
Fowl ___
Desserts ___
French fried foods ___

Number of servings (cups, glasses or containers) per week you usually consume of:

Homogenized (whole) milk ___
Skim (non-fat) milk ___
Two percent (2% fat) milk ___
Buttermilk ___
Tea (iced or hot) ___
Coffee ___

Do you ever drink alcoholic beverages? yes ☐ no ☐

If yes, what is your approximate intake of these beverages?

	None	Occasional	Often	If often, how many drinks per week?
Beer	☐	☐	☐	___
Wine	☐	☐	☐	___
Hard Liquor	☐	☐	☐	___

At any time in the past were you a heavy drinker (consumption of 6 oz. of hard liquor per day or more)? yes ☐ no ☐

46 Comments: ______________________________
____

PLEASE PRINT

DO NOT WRITE IN THIS SPACE: FOR OFFICE USE ONLY.

PATIENT NUMBER	VISIT	CARD	FORM	CLINIC
		5 0	M 0 2	B

EXERCISE

50 Are you currently involved in a regular exercise program? yes ☐ no ☐

Do you regularly walk or run one or more miles continuously? yes ☐ no ☐ don't know ☐

If yes, average no. of miles you cover per workout or day: ____ miles

What is your average time per mile? ____ minutes: seconds don't know ☐

Do you practice weight lifting or home calisthenics? yes ☐ no ☐

Are you now involved in the Aerobics program? yes ☐ no ☐

If yes, your average Aerobics points per week: ____

Have you taken in the past 6 months: ☐ 12 minute test ☐ 1.5 mile ☐ neither

If yes, your miles in 12 minutes: ____ or your time for 1.5 miles: ____ minutes : seconds

Do you frequently participate in competitive sports? yes ☐ no ☐

If yes, which one or ones?

☐ Golf ☐ Bowling ☐ Tennis ☐ Handball ☐ Soccer

☐ Basketball ☐ Volleyball ☐ Football ☐ Baseball ☐ Track

☐ Other ____

Average number of times per month ____

51 In which of the following high school or college athletics did you participate?

☐ None ☐ Football ☐ Basketball ☐ Baseball ☐ Soccer

☐ Track ☐ Swimming ☐ Tennis ☐ Wrestling ☐ Golf

☐ Other ____

In which of the following high school or college athletics did you earn a varsity letter?

☐ None ☐ Football ☐ Basketball ☐ Baseball ☐ Soccer

☐ Track ☐ Swimming ☐ Tennis ☐ Wrestling ☐ Golf

☐ Other ____

52 What activity or activities would you prefer in a regular exercise program for yourself?

☐ Walking and/or running ☐ Bicycling (outdoors) ☐ Swimming

☐ Stationary running ☐ Stationary cycling ☐ Tennis

☐ Jumping rope ☐ Handball, basketball or squash

☐ Other ____

53 Comments: ____

____

Explain any other significant medical problems that you consider important for us to know:

55 ____

____

56 ____

____

57 ____

____

58 ____

____

59 ____

____

60 ____

____

61 ____

____

PLEASE PRINT

APPENDIX B

INFORMED CONSENT

INFORMED CONSENT FOR EXERCISE TESTING

INSTITUTE FOR AEROBICS RESEARCH
11811 Preston Road
Dallas, Texas 75230

The undersigned hereby voluntarily consents to engage in a maximum exercise test to determine maximum oxygen intake and cardiovascular function. The test will be monitored continuously by an electrocardiogram recording and oscilloscope. This test will facilitate evaluation of cardiopulmonary function and assist the physician or exercise physiologist in prescribing or evaluating exercise programs. It [illegible] my understanding that I will be questioned and examined by a physician prior to taking the test and will be given a resting electrocardiogram to exclude contraindications to such testing.

Exercise testing will be performed by running, walking, swimming or riding a bicycle, with the workload increasing every few minutes until fatigue or breathlessness or other symptoms dictate cessation of the test. Blood pressure and electrocardiogram will be monitored by a physician or trained exercise physiologist. In the latter case, a physician will be readily available in case of emergency.

There exists the possibility that certain changes may occur during the progress of the test. These changes could include abnormal heart beats, abnormal blood pressure and in rare instances a "heart attack". Professional care in selection and supervision of individuals provides appropriate precaution against such problems.

The benefits of such testing are the scientific assessment of working capacity and the clinical appraisal of health hazards which will facilitate prescription of conditioning-rehabilitative exercise. Records will be held in strict confidence from non-medical people (such as employers and insurance agents) unless consent is obtained. The welfare of persons being tested is safeguarded by professional care and by the availability of emergency treatment should it be necessary.

Finally, I permit registration of my name for possible follow-up purposes in the future.

Further, the undersigned releases and discharges the Institute for Aerobics Research and the International Association of Chiefs of Police, their officers, agents, staff, faculty, physicians, technicians and any others connected therewith from all claims or damages whatsoever that the undersigned or his representatives may have arising from, or incident to this test.

Signed__________________________

Witness_________________________

Date___________________________

Physician or Exercise Physiologist Supervising Test

____

APPENDIX C

AEROBICS EXERCISE LOG

11811 PRESTON ROAD DALLAS, TEXAS 75230 (214) 661-3374

NAME (LAST, FIRST) PROJECT AGE HEIGHT SEX MONTH YEAR GROUP NUMBER

DEFINITION OF CODES

MODE:

TRK = Track or field
TML = Treadmill
BIK = Stationery cycling

WEEK:

Week number in training study

WO:

Workout number in current week (e.g. 1, 2, 3, 4, 5)

INT:

Intensity of workout interval
H = High (e.g. jog/run)
L = Low (e.g. walk/jog)

DISTANCE:

For Track: distance of one interval
For Treadmill: speed of treadmill in miles/hour
For Bike: load in kilogram-meters/min. (e.g. 300, 600, etc.)

PACE:

Time for one interval

REPS:

Number of repetitions of an interval

TIME:

For Track: leave blank
For Treadmill or Bike: total time at pace

HR:

Ten second heart rate times six taken at the middle and end of workout

WEIGHT:

Body weight to nearest ½ pound prior to workout

TOTAL TIME:

Total time of entire workout

MODE	WEEK	WO	INT	DISTANCE	PACE	REPS	TIME	INT	DISTANCE	PACE	REPS	TIME	MID-HR	END-HR	WEIGHT	TOTAL TIME

(continue on back side)

MODE	WEEK	WO	INT	DISTANCE	PACE	REPS	TIME	INT	DISTANCE	PACE	REPS	TIME	MID-HR	END-HR	WEIGHT	TOTAL TIME

4.10

BIBLIOGRAPHY

ANNOTATED BIBLIOGRAPHY

Books

American College of Sports Medicine. *Guidelines for Graded Exercise Testing and Exercise Prescription*. Philadelphia: Lea & Febiger, 1975. The format of the Guidelines was developed as a largely descriptive treatment of how to organize and administer exercise testing and prescription. It includes the application of testing and prescription procedures to the entire population. Behavioral objectives are offered to prepare personnel for developing programs.

Astrand, P.O. and Rodahl, K. *Textbook of Work Physiology*. New York: McGraw-Hill, 1970. The purpose of the text is to present various factors affecting human physical performance in a manner comprehensible to the physiologist, physical educator, and the clinician. The emphasis is on the regulation of various functions of the body at rest and during exercise. Basic physiological principles are followed by their application to testing, training, nutrition, physical fitness, and health.

Asmussen, E.: "The neuromuscular system and exercise." In: Falls, H.B. (ed.). *Exercise Physiology*. New York: Academic Press, 1968. The chapter in the text emphasized the physiology of muscles. Particular attention is given to the measurement and training of strength and muscular fatigue.

Balke, B.: "Prescribing physical activity." In: Lawson, L. (ed.). *Sports Medicine*. New York: Academic Press, Inc., 1974, pp. 505-523. In this chapter, the author elaborates on a means for prescribing exercise. Emphasis is placed on an individualized program, taking into account frequency, intensity, and duration of training.

Behnke, A.R. and Wilmore, J.H. *Evaluation and Regulation of Body Build and Composition*. Englewood Cliffs: Prentice-Hall, 1974. Techniques for determining body density and body fat by underwater weighing, water displacement, skinfolds, and anthropometric measurements are presented. Discussions on how body composition (fat/lean ratio) is affected by diet and training are offered.

Berger, R.A. *Conditioning for Men*. Boston: Allyn and Bacon, 1973. The approach of the book is to provide information necessary for an individual to make a self-evaluation of his strengths and weaknesses in physical ability. General principles of developing an exercise program based on weaknesses are offered. Of special interest in this text are descriptions of weight training and calisthenic exercises.

Books

Clarke, H.H. Muscular Strength and Endurance in Man. Englewood Cliffs: Prentice-Hall, 1966.
The measurement of strength using cable tensiometry is presented in this text. Relationships of strength with muscle fatigue are also discussed. This is an excellent reference source for strength testing techniques.

Consolazio, R., Johnson, R., and Pecora, L. Physiological Measurements of Metabolic Function in Man. New York: McGraw-Hill, 1963.
The basic methods of measuring respiratory metabolism, cardiopulmonary function, and body composition are presented. Of particular importance in this test are the analytical procedures for determining oxygen consumption and energy expenditure.

Cooper, K.H. Aerobics. New York: Bantam Books, 1968.
Written as a motivational tool for the layman of physical fitness, this book describes a unique point system for measuring progress toward maximal health. Exercise is quantified in terms of mode, duration, and intensity (total energy cost) by the aerobics point system. Therefore, an individual is able to follow his progress in an exercise program by using a tangible, meaningful point system. Minimum standards for assessing and maintaining cardiorespiratory fitness are described.

Cooper, K.H. The New Aerobics. New York: M. Evans and Company, Inc., and Bantam Books, Inc., 1970.
As a follow-up to his first book on Aerobics, Cooper updated the point system to include more activities and age-adjusted fitness programs. This book is more of a "Handbook" on specific programs to follow.

Cooper, M. and Cooper K.H. Aerobics for Women. New York: M. Evans and Company, Inc., and J.B. Lippincott Company, 1972.
To meet the need for reaching the female exercises, this book offers specific programs for females. The two previous books on Aerobics by Cooper contained data strictly for men. This book presents the data collected on women and a point system strictly applicable for the female of any age.

Cureton, T.K. The Physiological Effects of Exercise Programs on Adults. Springfield: Charles C Thomas, Co., 1969.
The basis of the book includes summaries of research studies concerning exercise programs for adults. The physiological effects of exercise are broadly summarized and then are followed by specific effects on specific physiological functions of the body. Physiological objectives on a fitness program are discussed.

Books

deVries, H.A. Physiology of Exercise for Physical Education and Athletics. Dubuque: W. C. Brown, 1966.
As a standard textbook for exercise physiology, this book includes the basic physiology underlying the effects of exercise. It also contains sections on the application of basic physiology to physical education and athletics.

Dubin, D. Rapid Interpretation of EKG's. Tampa: COVER Publishing Co., 1970.
Written in a programmed-text style, this book starts with the basic electrophysiology of the heart and progresses to interpretation of electrocardiograms (ECG). The emphasis is on teaching the reader to rapidly recognize ECG abnormalities.

Gledhill, N. and Eynon, R.B.: "The intensity of training." In: Taylor A.W., (ed.). Training Scientific Basis and Application. Springfield: Thomas, 1972, pp. 97-102.
This chapter in the text deals with a study examining the effects of different training intensities on cardiorespiratory fitness. In order to produce significant improvements in maximal oxygen intake, the intensity of training had to be strenuous enough to elicit heart rates of at least 135 beats/min. Groups that were highly fit initially only improved when the training stimulus was high (170 beats/min).

Hooks, G. Application of Weight Training to Athletics. Englewood Cliffs: Prentice-Hall, Co., 1970.
The author describes the basic principles for developing muscular strength. Various principles of weight training are outlined. Exercise programs for specific sports are described.

Kasch, F.W. and Boyer, J.L. Adult Fitness Principles and Practices. San Diego: San Diego State College, 1968.
This book is a primer and guide for adult fitness programs. It is a "how to do it" book. Topics include principles for starting a program, practical tests for evaluation, example programs, and exercise precautions.

Kilbom, A.: "How to obtain physical fitness.: In: Larson, O.A. and Malmborg, R.Q. (eds.). Coronary Heart Disease and Physical Fitness. Baltimore: University Park Press, pp. 175-179, 1971.
Kilbom presents information on the components of physical fitness and minimum efforts required to obtain fitness. Of the multiple factors of good physical fitness, oxygen transport and utilization are the most important for decreasing the risk for coronary heart disease. Physical fitness can be obtained, at least in sedentary subjects, by training for 1/2 hour three times a week, and the training intensity need not be maximal.

Books

Larson, L.A. (ed.). *Fitness, Health, and Work Capacity: International Standards for Assessment*. New York: Macmillan, 1974.
The text represents collected efforts by members of the International Committee for the Standardization of Physical Fitness Tests. Measurement instruments and procedures as well as the basis for health and fitness are presented. Chapters include information on the medical exam, physique and body composition, applied physiology, and physical fitness measurements.

Mathews, D.K. and Fox, E.L. *The Physiological Basis of Physical Education and Athletics*. Philadelphia: Saunders, 1971.
Written for the physical educator and coach, this text presents essential materials for the safe conduct of sport and physical education programs. The authors show direct application of physiological concepts to practical problems that occur in exercise. Topics of energy sources, strength, endurance, flexibility, interval training, heat balance, and cardiorespiratory system are covered.

Melograno, V.J. and Klinzing, J.E. *An Orientation to Total Fitness*. Dubuque: Kendall-Hunt, 1974
Total fitness is discussed in its subparts of social, emotional, mental, and physical. Information on warm-up, endurance, muscle training, motorability, mechanics, and weight control is included. Basic principles with example programs within each of the above topics are described.

Morehouse, L.E. and Miller, A.T. *Physiology of Exercise.* St. Louis: C.V. Mosby, 1971.
As a textbook on exercise physiology, this book offers a basic physiological background necessary to understand the response of the body to exercise. Also included are chapters on fatigue, training, fitness, and health.

Myers, C.R., Golding, L.A., and Sinning, W.E. (eds.). *The Y's Way to Physical Fitness*. Emmaus: Rodale Press, 1973.
Written in a "cookbook" style, this manual is offered as a guide to the exercise program director. Planning, organizing, and administering fitness programs are discussed along with the basic exercise physiology principles underlying specific programs of exercise. A chapter on testing is a significant contribution to the practical methods for evaluating fitness.

Books

Naughton, J.P., and Hellerstein, H.K. (eds.). *Exercise Testing and Exercise Training in Coronary Heart Disease*. New York: Academic Press, 1973. Exercise should be continuous, rhythmic, moderate, and of an endurance nature to produce significant changes in cardiorespiratory condition, body fat, blood fat, muscle tone,and aerobic capacity. Book also contains information concerning the conducting of exercise programs with cardiac patients.

Pariskova, J.: "Impact of age, diet, and exercise on man's body composition." In: Johl, E. and Simond, E. (eds.). *Inter. Res. Sport Phys. Educ.* Springfield: Charles C. Thomas, 1964.
Dieting alone is not an effective way to reduce fatness. A combination of exercise and diet restriction is recommended. Exercise induces reduction in percent fat along with increases in muscle mass.

Physical Fitness for Law Enforcement Officers. Washington, D.C.: Federal Bureau of Investigation, 1972.
This manual was written to make the law enforcement officer more aware of the importance of physical fitness and to provide guidelines for improving fitness. It includes sections on self-evaluation, self-conditioning, exercise programs for cardiovascular fitness and strength, and weight control.

Physical Fitness Program. Washington, D.C.: United States Secret Service Training Division, 1972.
Part one of this manual provides methods whereby agents can measure their physical condition in relation to others. Part two provides general programs of exercise for all employees and their families.

Pollock, M.L., Tiffany, J., Gettman, L., Janeway, R., and Lofland, H.: "Effects of frequency of training on serum lipids, cardiovascular function, and body composition." In: Franks, A.O. (ed.). *Exercise and Fitness*. Chicago: Athletic Institute, 1969, pp. 161-178.
Two-day and four-day per week training programs were examined and both groups improved significantly in cardiovascular function. Only the four-day group lost fat through the study. No changes in serum cholesterol were observed over the 16-week study. Serum triglycerides were significantly reduced during this same time span.

Pollock, M.L.: "The quantification of endurance training programs." In: J. Wilmore (ed.). Exercise and Sport Sciences Reviews. New York: Academic Press, 1973, pp. 155-188.

This chapter is a review of studies dealing with the quantification of exercise programs in terms of intensity, diration, and frequency. These are discussed with reference to mode of activity, age of participant, and initial level of fitness.

Books

Pollock, M.L., Gettman, L.R., and Milesis, C.A. Physical Fitness Manual for Correctional Institutions. Dallas: Institute for Aerobics Research, 1975.
The manual includes information concerning the need for exercise by inmates. Principles of exercise are discussed and guidelines for medical screening, fitness evaluation, and exercise prescription are provided. The results from two major studies involving state prison and county jail inmates are summarized. Chapters on administrative considerations and physiological and psychological findings are also included.

Rasch, P.J. Weight Training. Dubuque: W. C. Brown Co., 1966.
The scientific principles of weight training are presented along with programs for beginners and advanced lifters. Specialized programs for competitors in various sports are described.

Sidney, K.H., Eynon, R.B., and Cunningham, D.A.: "The effect of frequency of exercise upon physical working capacity and selected variables representative of cardiorespiratory fitness." In: Taylor, A.W. (ed.). Training Scientific Basis and Application. Springfield: Thomas Co., 1972, pp. 144-148.
When total work was held constant, a training frequency of two days per week was found to be similar to four days per week in improving aerobic capacity. A one-day per week program showed little advantage over no training at all.

Skinner, J.: "The cardiovascular system with aging and exercise." In: Brunner D. and Yokl E. (eds.). Physical Activity and Aging. Baltimore: University Park Press, 1970, pp. 100-108.
Data suggest an approximate 21 to 30 percent decrease in oxygen intake over a 30 to 40 year range.

Wilson, P. Adult Fitness and Cardiac Rehabilitation. Baltimore: University Park Press, 1975.
This book contains a compilation of materials concerning the organization and administrative aspects of developing a cardiac rehabilitation program. Emphasis is placed on safety, stress testing, and exercise prescription.

Periodicals

American College of Sports Medicine: "Prevention of heat injuries during distance running." Med. Sci. Sports. 7:1, vii, 1975.
A position statement by ACSM is based on research findings which stress no distance races should be run during extremely high temperatures and humidity. Fluid replacement is very important when exercising in the heat.

Astrand, I.: "Aerobic work capacity in men and women with special reference to age." Acta. Physio. Scand. 49, Suppl. 169: 211-217, 1960.
The basic difference in aerobic working capacity between men and women is shown. Age was shown to have a negative effect on working capacity for both men and women.

Barnard, R.J., Gardner, G.W., Diaco, N.V., MacAlpin, R.N., and Kattus, A.A.: "Cardiovascular response to sudden strenuous exercise - heart rate, blood pressure, and ECG." J. Appl. Physiol. 34:833-837, 1973.
A variety of subjects including marathon runners and sedentary men were asked to run on a treadmill at 9 mph, 30% grade for 10 seconds without prior warm-up. At another time, 2 min of easy jogging for warm-up preceeded the run. Without warm-up, 68% had abnormal ECG changes and these changes disappeared or were reduced in severity when warm-up was allowed. The study emphasizes the importance of warm-up prior to strenuous physical activity.

Barnard, R.J., MacAlpin, R.N., Kattus, A.A., and Buckberg, G.D.: "Ischemic response to sudden strenuous exercise in healthy men." Circulation 48:936-842, 1973.
Abnormal increases in blood pressure were observed on 10 men when sudden strenuous exercise was performed without prior warm-up. The abnormal increase in blood pressure greatly increased the oxygen demand of the hearts and abnormal ECG changes were observed. When 15-20 min. of warm-up was allowed, the ECG changes disappeared or were reduced in severity.

Benoit, F.L., Martin, R.L., and Watten, R.H.: "Changes in body composition during weight reduction in obesity." Ann. Intern. Med. 63:604-612, 1965.
Dieting alone will cause a reduction in weight but 65% of the weight loss is from muscle mass and only 35% from fat tissue. Exercise programs with no restriction on food intake can reduce fat and increase muscle tissue with total body weight staying approximately the same.

Boileau, R.A. and associates: "Body composition changes in obese and lean men during physical conditioning." Med. Sci. Sports 3:183-189, 1971.
College men classified into obese (25-46% fat) and lean (10-21% fat) categories participated in nine weeks of running and walking five days per week. The men lost fat while body density increased.

Periodicals

Brozek, J., Grande, F., Anderson, J., and Keys, A.: "Densiometric analysis of body composition: revision of some quantitative assumptions." *Ann. N.Y. Acad. Sci.* 110:113-140, 1963.
This reference serves as a basis for calculating body density (measured by various techniques) to precent body fat using the following formula: $\% \text{ Body Fat} = \left(\frac{4.57}{D} \right) - 4.142 \times 100$

Bruce, R.A.: "Exercise testing of patients with coronary heart disease." *Ann. Clin. Res.* 3:323-332, 1971.
A description of an exercise stress test is provided as a valuable screening device for detecting coronary heart disease. The test requires a treadmill and is multistage starting at 1.7 mph, 10% grade and progressing in speed and grade every three minutes to a person's maximum voluntary effort.

Chapman, J.M. and Massey, F.J.: "The interrelationship of serum cholesterol, hypertension, body weight, and risk of coronary disease." *J. Chronic Dis.* 17:933-949, 1964.
The characteristics of high serum cholesterol level, high blood pressure (hypertension), and obesity (excessive fat) were identified with a high incidence of coronary heart disease.

Cooper, K.H.: "Correlation between field and treadmill testing as a means of assessing maximal oxygen intake." *JAMA* 203:201-204, 1968.
A high correlation (r = 0.9) was observed between the 12-minute results on a track with the maximum oxygen intake test on the treadmill. This allows a practical means of assessing cardiovascular function.

Cooper, K.H.: "Guidelines in the management of the exercising patient." *JAMA* 211:1663-1667, 1970.
The author suggests guidelines that will help make stress testing and exercise prescription safer.

Cooper, K.H. and Zechner, A.: "Physical fitness in United States and Austrian military personnel." *JAMA* 215:931-934, 1971.
This study showed that the cardiorespiratory fitness of Austrian soldiers was much higher than American Air Force personnel and that the decline in fitness from ages 19 to 29 years was less among the Austrians. Also, the 29-year-old Austrians performed better than the 19-year-old Americans.

Periodicals

Corbin, B., Berryhill, D., and Olree, H.: "Effects of running, exercising on the treadmill, and exercising on the bicycle ergometer at equal heart rates on specified components of physical fitness." In: Abstracts of Research Papers 1968 AAHPER Convention, p. 33.
Twenty college men were trained at equal heart rates 5 days per week for 10 weeks using running, treadmill walking, and bicycle modes of training. Results in fitness tests showed the improvements were best in the running group followed by the bicycle groups and treadmill walk group last.

Costill, D. and Fox E.: "Energetics of marathon running." Med. Sci. Sports 1:81-86, 1969.
Six nationally ranked marathoners were examined during treadmill running and were found to average 71.4 ml/kg.min oxygen consumption. They averaged 75% of their aerobic capacities while running a marathon distance.

Cureton, T.K. and Phillips, E.E.: "Physical fitness changes in middle-aged men attributable to equal eight-week periods of training, non-training and retraining." J. Sports Med. Phys. Fitness 2:87-93, 1964.
Cardiorespiratory efficiency fluctuated significantly from improvement to decrement to improvement during periods of training, non-training, and retraining.

Davies, C.T.M. and Knibbs, A.V.: "The training stimulus, the effects of intensity, duration, and frequency of effort on maximum aerobic power output." Int. Z. Angew. Physiol. 29:299-305, 1971.
Men were trained at 80, 50, and 30 percent of maximum oxygen intake; 20, 10, and 5 minutes per session; 5, 3, and 1 days per week for 8 weeks. Greater improvement in aerobic capacity was achieved with higher intensity programs.

Davis, J.A. and Convertino, V.A.: "A comparison of heart rate methods for predicting endurance training intensity." Med. Sci. Sports 7:295-298, 1975.
The Karvonen method (KM) of determining percentage of maximum heart rate for quantifying intensity of exercise was compared to actual measured intensities of oxygen intake. The KM accurately predicted the exercise intensity.

deVries, H.A.: "Physiological effects of an exercise training regimen upon men aged 52 to 88." J. Gerontol. 25(4):325-366, 1970.
Subjects who participated in a low-intensity exercise program improved but the relative change was less than for younger subjects.

Periodicals

Drinkwater, B.L. and Horvath, S.M.: "Detraining effects on young women." Med. Sci. Sports 4:91-95, 1972.
Three months after track season, cardiorespiratory fitness decreased significantly in seven female athletes who engaged in no training. The fitness levels decreased to levels found in nonathletic girls of the same age.

Fardy, P.S.: "Effects of soccer training and detraining upon selected cardiac and metabolic measure." Res. Quart. 40:502-508, 1969.
Throughout the course of a season of soccer competition cardiorespiratory efficiency improved, but significant reductions occurred after the season during a nontraining period.

Fox, S.M., Naughton, J.P., and Haskell, W.L.: "Physical activity and the prevention of coronary heart disease." Ann. Clin. Res. 3:404-432, 1971.
Physical exercise programs have been shown to reduce the severity and number of risk factors such as serum lipids, obesity, high blood pressure, and ECG abnormalities in coronary heart disease. This suggests the protective value of regular exercise.

Gettman, L.R., Pollock, M.L., Ayres, J.J., Durstine, L., Ward, A., Linnerud, A.C.: "Physiological responses of men to 1, 3, and 5 day per week training programs." Res. Quart. In Press, 1976.
This study on county jail inmates found that physiological improvements occurred in direct proportion to frequency of training. However, even though the 5-day group improved the most, it had the most motivation problems and incidence of leg soreness and muscle injury. Therefore, the recommended program for beginning exercisers is 3 days per week, 30 min. per session.

Grimby, G., Saltin, B.: "Physiological analysis of physically well-trained middle-aged and old athletes." Acta. Med. Scand. 179(5):513-526, 1966.
These data showed that men who continued to train all their lives were superior in cardiorespiratory function compared to their sedentary counterparts.

Gwinup, Grant: "Effect of exercise alone on the weight of obese women." Arch. Int. Med. 135:676-680, 1975.
Eleven obese women exercised daily for one year or longer with no restriction on diet. No weight loss occurred until walking exceeded 30 minutes daily. Weight loss was directly related to length of time spent walking.

Periodicals

Hollman, W. and Venrath, H.: "Experimentelle untersuchunger zur bedentring eines trainings unterhalb and oberhalb der dauerbeltzstungsgranze." In: Korbs (ed.) Carl Diem Festschrift. W.U.A. Frankfurt: Wein, 1962. Improvements in aerobic capacity were seen in 10 subjects who did just 10 minutes of stationary running per day for three months.

Kannel, W.B.: "Factors of risk in the development of coronary heart disease - six year follow-up experience." Ann. Inter. Med. 55:33-42, 1961. In studying large populations to determine probable cause of death from coronary heart disease, the following risk factors were identified: high serum cholesterol and triglycerides, obesity, high blood pressure, smoking, ECG abnormalities, glucose intolerance, and physical inactivity.

Kannel, W.B., Dawber, T.R., Friedman, G.D., Glennon, W.E., and McNamara, P.M.: "Risk factors in coronary heart disease: an evaluation of several serum lipids as predictors of coronary heart disease." Ann. Inter. Med. 61:888-894, 1964.
High cholesterol and triglycerides (fats) levels in the blood were shown to be risk factors in coronary heart disease.

Karvonen, M., Kentala, K., and Muslala, O.: "The effects of training heart rate : a longitudinal study." Ann. Med. Exptl. Biol. Fenn. 35:307-315, 1957.
This study found that fitness improvements can be expected only when training intensity is above 60% maximum heart rate. Percent maximum heart rate intensity is calculated by the following: % max HR = (Max HR - Rest HR) .60 + Rest HR.

Kasch, F.W., Phillips, W.H., Carter, J.E.L., and Boyrer, J.L.: "Cardiovascular changes in middle-aged men during two years of training." J. Appl. Physiol. 34:53-57, 1973.
In training men for 30 minutes, 3 days/week, for two years, it was found that cardiorespiratory fitness was improved for approximately one year. In the second year fitness leveled off and was maintained.

Katch, F.I., Michael, Jr., E.D., and Jones, E.M.: "Effects of training on the body composition and diet of females." Res. Quart. 40:99-104, 1969. The results of this study differed from previous investigations which have shown that body composition changes (fat decreases and lean increases) during physical training programs. Female members of tennis and swimming teams were tested during 16 weeks of sports training. No changes in body composition or dietary patterns were observed.

Periodicals

Kendrick, Z.B., Pollock, M.L., Hickman, T.N., and Miller, H.S.: "Effects of training and detraining on cardiovascular efficiency." Amer. Corr. Ther. J. 25:79-83, 1971.
Middle-aged men trained eight miles per week for 20 weeks and then were divided into three groups. Group A continued to train eight miles per week, Group B trained three miles per week, and Group C was inactive. Group A maintained or improved in cardiovascular efficiency,and Groups B and C regressed significantly. Group C lost approximately 50% of its original improvement.

Kilbom, A.L., Hartley, B., Saltin, J., Bjure, J., Grimby, G., and Astrand, I.: "Physical training in sedentary middle-aged and older men." Scan. J. of Clin. and Lab. Inv. 24:315-322, 1969.
These data showed that middle-aged and older men adapted quite well to endurance training. Men with a lower intial level of fitness appeared to improve their fitness the most.

Ladell, W. "The effects of water and salt intake upon the performance of men working in hot and humid environments." J. Physiol. 127:11-46, 1955.
Data show the importance of water and salt intake during hot and humid conditions.

Lindell, J. "Year-around police fitness training." Criminal Justice Dig. 3:1-2, 1975.
Article describes the need for physical conditioning programs for police.

Mayhew, J.L. and Gross, P.M.: "Body composition changes in young women with high resistance weight training." Res. Quart. 45:433-439, 1974.
Over a 9-week weight training period, 17 college women increased in lean body mass and decreased in relative fat. Total body weight did not change nor did skinfold thicknesses. High resistance weight training can enhance body composition without concomitant masculinizing effects or changes in body weight.

McNamara, J.J., Molot, M.A., Stremple, J.R., and Cutting, R.T.: "Coronary artery disease in combat casualties in Vietnam." JAMA 216:1185-1186, 1971.
Autopsy reports on casualties in Vietnam showed a high incidence of atherosclerosis. Data were similar to those found with casualties from the Korean war.

Milesis, C.A.: "Effects of metered physical training on serum lipids of adult men." J. Sports Med. and Physical Fitness 14:8-13, 1974.
Data showed a significant lowering of serum cholesterol with endurance training.

Periodicals

Milesis, C., Pollock, M.L., Ayres, J., Bah, M., Ward, A., and Linnerud, A.C.: "Effects of different durations of training on cardiorespiratory function, body composition and serum lipids." Res. Quart. In Press. Inmates from a state prison trained 15, 30, or 45 min., 3 days per week for 20 weeks. Physiological improvements occurred in direct proportion to duration of training. However, the incidence of leg injury was highest in the 45-min group. Therefore, beginning exercisers are recommended to follow the 30-min, 3-day per week program.

Moody, D.L., Dollins, J., and Buskirk, E.: "The effects of a moderate exercise program on body weight and skinfold thickness in overweight college women." Med. Sci. Sports 1:75-80, 1969.
Eleven overweight college women participated in a 6-day per week walk/jog program for eight weeks. Significant losses in fat with gains in fat-free weight occurred.

Morgan, W.P., Roberts, J.A., Brand, R.F., and Feinerman, A.D.: "Psychological effect of chronic physical activity." Med. Sci. Sports 2:213-217, 1970.
Depression is not significantly correlated with age, height, weight, percent fat, grip strength, or physical work capacity in adult males. Males who were depressed initially showed a significant reduction of depression following six weeks of chronic exercise.

Neuberger, T.: "What the Research Quarterly says about Warm-up." J. Health, Phys. Educ. and Rec. 40:75-77, 1969.
A summary of several studies on warm-up supports the contention that improvements in physical performance (such as running, jumping, and throwing) are significant following active warm-up.

Pascale, L.R., Grossman, M.I., Sloane, H.S., and Frankel, T.: "Correlations between thickness of skinfolds and body density in 88 soldiers." Human Biol. 28:165-176, 1956.
Among several skinfold measures, the best predictors of body density were the chest, axilla, and triceps locations. The formula for predicting density is:
D = 1.088468 - (.007123 x Axilla) - (.004834 x Chest) - (.005513 x Triceps)

Passmore, R. and Durnin, J.U.G.A.: "Human energy expenditure." Physiol. Rev. 35:801-840, 1955.
The kilocalorie cost of different activities ranging from low levels to very high levels (running) is presented. This serves as a basis for quantifying various activity programs on the basis of energy cost.

Periodicals

Pohndorf, R.H. and Cathey, R.E.: "Fitness changes during a 14-week basic law enforcement training program." FBI Law Enforce. Bull. Jan., 1975, pp. 20-24.
The purpose was to assess the initial fitness level of 17 law enforcement trainees at a police institute and then see what changes might occur during a 14-week training program. Initially the men had poor cardiovascular efficiency and improved very little in the limited program of 1 1/2 hrs per week of exercise. The candidates were overfat, and their handgrip strengths and balance scores were below average. Flexibility, verticle jump, dips, and agility scores were satisfactory. A definite need for physical fitness tests incorporated into the selection system for law enforcement trainees was stated.

Pollock, M.L., Cureton, T.K., and Greninger, L.: "Effects of frequency of training on working capacity, cardiovascular function, and body composition of adult men." Med. Sci. Sports 1:70-74, 1969.
Men training 30 min for two days per week were compared with a group of men training four days per week on cardiovascular and body composition measures. Both groups improved in cardiovascular endurance; however, only the four-day group significantly decreased body fat. Between-group analyses showed that improvements were manifested in accordance with frequency of participation.

Pollock, M.L., Miller, H., Janeway, R., Linnerud, A.C., Robertson, B., and Valentine, R.: "Effects of walking on body composition and cardiovascular function of middle-aged men." J. Appl. Physiol. 30:126-130, 1971.
Vigorous walking training produced significant improvements in cardiovascular function and body composition of men 40 to 55 years of age. The men trained 40 min., 4 times/week for 20 weeks and progressed from 2.5 miles during week one to 3.25 miles during weeks 16-20. Because of the significant improvements and low incidence of orthopedic problems and low dropout rate, walking training was strongly recommended for the adult population.

Pollock, M.L., Broida, J., and Kendrick, Z.: "Validation of the palpation technique for estimation of training heart rate." Res. Quart. 43:77-81, 1972.
No significant differences were found between heart rates recorded by ECG telemetry and those taken by subjects using the carotid pulse method. Heart rates were recorded by both methods 10 seconds after stopping exercise and were similar to those during the exercise just before stopping. Therefore, counting the heart rate for 10 seconds after stopping exercise is a valid technique for estimating exercise heart rate.

Periodicals

Pollock, M.L., Broida, J., Kendrick, Z., Miller, H.S., Jr., Janeway, R., and Linnerud, A.C.: "Effects of training two days per week at different intensities on middle-aged men." Med. Sci. Sports 4:192-197, 1972. Training 45 min 2 days/week at 80% and 90% maximum heart rate had a significant effect on cardiovascular function, but little effect on body composition. When total calorie cost of the two programs were held constant no significant differences existed between the 80% and 90% training intensities.

Pollock, M.L., Miller, H.A., Jr., Linnerud, A.C., Royster, C., Smith, W., and Sonner, W.: "Physiological findings in well-trained middle-aged American men." Brit. J. Sports Med. 7:222-229, 1973. Thirty-two men, 38 to 57 years of age, who had been training for 5.8 years were found to be excellent in work capacity, cardiovascular function, and body composition when compared to sedentary and moderately trained populations of comparable age.

Pollock, M.L.: "Steps for initiating an endurance exercise program." Rec. Manag. 17:26-32, 1974. With an increased concern about heart disease by the adult population, the primary considerations for starting an exercise program are the following: medical and fitness evaluations; stress test; intensity of exercise at least 60% of maximum heart rate; duration of 15 to 60 minutes per session; and frequency of at least 3 days per week. Special considerations of warm-up and taper-down, leg and foot problems, hot and humid environments, and motivation are discussed.

Pollock, M.L., Miller, H.S., Linnerud, A.C., Coleman, E., Laughridge, E.E., Ward, B.A.: "Follow-up study on the effects of conditioning four days per week on the physical fitness of adult men." Am. Correct. Ther. J. 28:135-139, 1974. Improvements were shown in cardiovascular function and body composition of middle-aged men with a 4-days/week conditioning regimen.

Pollock, M.L., Miller, H.S., Linnerud, A.C., Laughridge, E.E., Coleman, A.B., Alexander, M.S.: "Arm pedaling as an endurance training regimen for the disabled." Arch. Phys. Med. Rehab. 55:418-424, 1974. Many disabled persons cannot train by conventional methods such as running, walking, or bicycling. Arm pedaling on a modified bicycle ergometer was found to be an effective training mode as both cardiovascular function and body composition improved signiciantly in a group of eight disabled men who trained 30 min., 3 days/week for 20 weeks.

Periodicals

Pollock, M.L., Miller, H.S., and Wilmore, J.: "Physiological characteristics of champion American track athletes 40 to 75 years of age." J. Gerontol. 29:645-649, 1974.
In a group of 25 champion American runners, results showed all to have excellent cardiovascular and body composition characteristics when compared to sedentary and moderately trained subjects of similar age. Maximal performance decreased with age and dramatic reductions occurred after age 60.

Pollock, M.L., Dimmick, J., Miller, H.S., Kendrick, A., Linnerud, A.C.: "Effects of mode of training on cardiovascular functions and body composition of adult men." Med. Sci. Sports 7:139-145, 1975.
Running, walking, and bicycle training were shown to be similar in effect on cardiovascular and body composition measures when frequency (3 days/week), duration (30 min/session) and intensity (85 to 90% maximum heart rate) of training were the same.

Pollock, M.L., Miller, H.S., Linnerud, A.C., and Cooper, K.H.: "Frequency of training as a determinant for improvement in cardiovascular function and body composition of middle-aged men." Arch. Phys. Med. Rehab. 58:141-145, 1975.
This report summarized the results from six training investigations conducted either four, three, or two days/week for 20 weeks. All frequencies had a significant effect on cardiovascular function but only three-and four-days/week regimens showed reductions in body weight and fat. The four-day/week programs improved maximum oxygen intake significantly greater than the three and two day/week programs.

Pollock, M.L., Laughridge, E.E., Coleman, B., Linnerud, A.C., and Jackson, A.: "Prediction of body density in young and middle-aged women." J. Appl. Physiol. 38:745-749, 1975.
The prediction of body density in women is enhanced when a variety of variables is evaluated. In this study, the highest predictions of body density were found by using combinations of skinfold, girth, and diameter variables. Prediction equations were developed for different age groups. Variables used for young women were thigh and suprailiac skinfolds, knee diameter, and wrist girth. For middle-aged women, the variables included cup size, thigh and suprailiac skinfolds, and waist girth.

Pollock, M.L., Hichman, T., Kendrick, Z., Linnerud, A.C., and Jackson, A.: "Prediction of body density in young and middle-aged men." J. Appl. Physiol. In press.
It was shown that prediction of body fat was best accomplished by using a combination of skinfold fat, girth, and diameter measures. Prediction equations were developed for different age groups. Variables used for young men included the sum of seven skinfolds, biacromial diameter, and height. For middle-aged men, the variables included chest and axilla skinfold and gluteal and forearm girth.

Periodicals

Pollock, M.L., Bohannon, R.L., Cooper, K.H., Ayres, J.J., Ward, A., White, S.R., Linnerud, A.C.: "A comparative analysis of four protocols for maximal treadmill stress testing." Amer. Heart J. In Press, 1976.
Four commonly used protocols for stress testing (Balke, Bruce, Ellestad, and a continuous multi-stage run) were compared by using heart rate (HR), oxygen intake (VO_2), and electrocardiogram response. All four tests showed similar maximal metabolic responses although the rate of increase in VO_2 and HR were different. The rapid initial increase made the running test undesirable as a screening method. A nomogram was developed comparing the Balke, Bruce, and Ellestad tests.

Pollock, M.L., Dawson, G., Miller, H.S., Ward, A., Cooper, D., Headley, W., Linnerud, A.C., Nomeir, A.: "Physiologic responses of men 49 to 65 years of age to endurance training." J. Am. Geriatc. Soc. In Press, 1976.
Twenty-two men 49 to 65 years old, trained 30 min., 3 days/week for 20 weeks. The subjects increased 18% in maximum oxygen intake and decreased in body fat, resting heart rate, and body weight. The changes were similar to other training studies with younger men and show a favorable trainability of older men.

Robinson, S.: "Experimental studies of physical fitness in relation to age." Arbeitsphysiol. 10:251-323, 1938.
This paper showed that men tend to peak in aerobic capacity between 17 and 20 years of age and steadily decrease over the subsequent years. At age 75, aerobic capacity is less than 50 percent of the original peak value.

Robinson, S., Dill, D.B., Tzunkoff, S.P., Wagner, J.A., and Robinson, R.D.: "Longitudinal studies of aging in 37 men." J. Appl. Physiol. 38:263-267, 1975.
Repeated measures of maximum oxygen intake (VO_2 max) were taken on 37 men at ages 18 to 22, then again at ages 40 to 44 and 49 to 53 years. At age 40 to 44, VO_2 max had declined 25 percent and had continued to decrease when reevaluated at ages 49 to 53.

Roskamm, H.: "Optimum patterns of exercise for healthy adults." Can. Med. Assoc. J. 96:895-899, 1967.
Eighteen subjects improved 20 percent in working capacity after four weeks of daily training. At this point, one group (Group I) continued training every third day and the other group (Group II) stopped training. Group I maintained their level of working capacity while Group II began to lose the increased level of working performance within two weeks.

Periodicals

Saltin, B., Blomqvist, G., Mitchell, J.H., Johnson, R.L., Wildenthal, K., and Chapman, C.B.: "Response to exercise after bedrest and after training." Circulation 38(suppl. 7): 1-78, 1968.
Five subjects were confined to bed for 20 days and then trained for 60 days. Cardiorespiratory efficiency values decreased during bed rest and improved steadily with training. Heart rate response to a submaximal test increased up to 30 beats/min after bed rest and decreased significantly with training.

Saltin, B., Hartley, L.H., Kilbom, A., Astrand, I.: "Physical training in sedentary middle-aged and older men. II. Oxygen uptake, heart rate, and blood lactate concentration at submaximal and maximal exercise." Scand. J. Clin. Lab. Invest. 24:323-334, 1969.
This study was an attempt to determine if aging affects the response to training. It was found that improvements in oxygen intake with training occurred as readily in middle-aged and old men as in young although the absolute change was less. Therefore, there appears to be some aging effect in men ages 29 to 63 years.

Sharkey, B.J. and Holleman, J.P.: "Cardiorespiratory adaptations to training at specific intensities." Res. Quart. 28:698-704, 1967.
The intensity of training must be high enough to elicit changes in cardiorespiratory endurance (CRE). In a study on 16 men divided into three different training groups, it was found that CRE improved significantly greater in men training at a heart rate of 180 beats/min compared to those training at 150 and 120 beats/min.

Sharkey, B.J.: "Intensity and duration of training and the development of cardiorespiratory endurance." Med. Sci. Sports 2:197-202, 1970.
Thirty-six men were randomly assigned to a 3 x 2 factorial design which included three levels of training intensities (heart rates of 130, 150, and 170 beats/min) and two levels of duration (7500 or 15,000 kpm total work). The six-week training program conducted three days per week showed no significant differences with different combinations of intensity and duration when the total amount of work was held constant.

Shephard, R.J.: "Intensity, duration, and frequency of exercise as determinants of the response to a training regime." Int. Z. Angew. Physiol. 26:262-278, 1969.
Ten exercise sessions were designed for men who trained at 96, 75, and 39 percent of maximum oxygen intake, 5, 3, and 1 days per week, for 20, 10, and 5 minutes per session. The highest intensity groups improved 20 percent in maximum oxygen intake while the 39-percent intensity group improved 5 to 10 percent. It was concluded that a lower threshold of training is possible for improvement with sedentary middle-aged groups who are at low levels of fitness.

Periodicals

Sigel, W., Blomqvist, G., Mitchell, J.H.: "Effects of a quantitated physical training program on middle-aged sedentary males." *Circulation* 41:19-29, 1970.
Nine sedentary middle-aged men trained 12 minutes, three days per week for 15 weeks and improved 19 percent in aerobic capacity. After completion of the program, five subjects continued to train once a week for another 14-week period. Their aerobic capacity decreased to 6 percent above the initial control level. The remaining four subjects who abstained from training fell below their initial control values.

Skinner, J.S., Holloszy, J.O., and Cureton, T.K.: "Effects of a program of endurance exercises on physical work." *Amer. J. Cardiol.* 14: 747-752, 1964.
This study found that exercising a minimum of three times per week, approximately 40 minutes per session for a period of six months was effective in increasing cardiorespiratory fitness and decreasing body fat in sedentary middle-aged men.

Stamford, B.A., Hambacher, W., and Fallica, A.: "Effects of daily physical exercise on the psychiatric state of institutionalized geriatric mental patients." *Res. Quart.* 45: 34-41, 1974.
Nine patients walked on a treadmill daily for 12 weeks and were evaluated for physiological and psychological changes. Accompanying a significant physiological effect was a significant change on two of four psychological tests which broadly reflected self-concept, awareness of immediate and expanded environment, and acute and long-term memory.

Stamler, J.: "Serum lipids as predictors of atherosclerotic disease." *Antherosclerotic Vascular Disease*. pp. 207-227.
High serum cholesterol and triglycerides (blood fat) were identified as risk factors for coronary heart disease.

Tzankoff, S.P., Robinson, S., Pyke, F.S. and Brown, C.A.: "Physiological adjustments to work in older men as affected by physical training." *J. Appl. Physiol.* 33:346-350, 1972.
Significant improvements were found in maximum oxygen intake with training in men 44 to 66 years of age. When the men were dichotomized by age, 44 to 53 and 54 to 66 years, the older men had lower work capacities initially but their percentage increase with training was greater.

Periodicals

Welham, W.C. and Behnke, A.R.: "The specific gravity of healthy men." JAMA 118:498-501, 1942.
When comparing trained and untrained individuals with the same average heights and weights, a greater proportion of the weight of the physically active person is in the form of lean tissue. In this study, a group of professional football players was compared to a group of naval personnel. It was found that although the football players were heavier, most of them had less body fat than the naval personnel.

Wilmore, J.H. and Behnke, A.R.: "An anthropometric estimation of body density and lean body weight in young men." J. Appl. Physiol. 27:25-31, 1969.
A very practical method for estimating lean body weight using just body weight and waist girth was presented. The formula is:
LBW = 98.42 + [1.082 (body weight) - 4.15 (waist girth)].

Wilmore, J.H., Royce, J., Girnadola, R.N., Katch, F.I., and Katch, V.L.: "Physiological alterations resulting from a 10-week program of jogging." Med. Sci. in Sports 2:7-14, 1970.
Different durations of training, 24 min vs 12 min, were compared in a study on 55 men training 3 days/week for 10 weeks. Both groups demonstrated significant improvements in cardiovascular measures Although the changes in the 24-min group were greater than in the 12-min group, the differences were not statistically significant.

Wilmore, J.: "Individual exercise prescription." Am. J. Cardiol. 33:757-759, 1974.
Basic principles of organizing and administering an adult physical fitness program are discussed. Emphasis is placed upon individualized exercise prescription.

Wilmore, J.H.: "Alterations in strength, body composition and anthropometric measurements consequent to a 10-week weight training program." Med. Sci. Sports 6:133-138, 1974.
Forty-seven women and twenty-six men participated in an intensive 10-week program of weight training. Both groups made similar relative gains in strength. The males were stronger and exhibited greater gains in muscle hypertrophy in the upper extremities. The women were stronger in the legs when strength was expressed per lean body weight. There were no moderate relationships of increased girths and strength but hypertrophy is not a predominant consequence of increased strength.

Periodicals

Yeager, S.A. and Brynteson, P.: "Effects of varying training periods on the development of cardiovascular efficiency of college women." *Res. Quart.* 41:589-592, 1970.
Young women who trained on a bicycle ergometer for 10, 20, or 30 minutes per day, three days per week for six weeks improved significantly in aerobic capacity. All durations of exercise were effective in producing improvements.

Zuti, W.B. and Golding, L.A.: "Comparing diet and exercise as weight reduction tools." *The Physician and Sports Med.* 4:49-53, 1976.
Twenty-five women created a 500 calorie per day deficit through dieting, exercise, or a combination of the two. All of the women lost weight but the greatest fat losses were by those people who exercised along with dieting.

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